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POWDERY SCAB IN POTATOES.

THE AUSTRALIAN EMBARGO.

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IN November, 1919, several small consignments of potatoes, totalling some four hundred sacks, were shipped from the Dominion to Melbourne. On arrival at that port they were found to be infected with powdery scab (*Spongospora subterranea* (Wall.) John.), and were promptly condemned by the Australian quarantine authorities. In consequence of these shipments the Commonwealth Government immediately placed a total embargo on the importation of New Zealand potatoes into any part of Australia except in quantities of not more than 14 lb. This action completely stopped a trade that had been carried on for many years past during seasons when a remunerative price was obtaining in Australia.

This year the high prices for potatoes in Australia, coupled with the overproduction and consequent low prices in New Zealand, made it extremely desirable that the embargo should be lifted. The Australian authorities, however, notwithstanding the repeated and earnest representations of the New Zealand Government, remained firm in their determination to exclude any importation of New Zealand potatoes. Finally a delegation, of which the writer was a member, was sent to

Australia in order to put the position fairly before the Commonwealth Government. It was then finally agreed to send an expert to New Zealand to determine whether or not New Zealand potatoes could be imported into Australia without any danger of the disease being introduced there. This agreement was arrived at mainly through the delegation's contentions that there were in New Zealand localized potato-growing areas where the disease had not been found, and that, at any rate, even where the disease was prevalent it had little, if any, significance on the production of potatoes.

The expert nominated by the Australian authorities is at time of writing making an extensive investigation of the main potato-growing districts of New Zealand, collecting all possible data, so as to determine whether or not the contentions of the delegates were correct, and to ascertain whether methods of shipment can be devised whereby, if exportation is resumed, any possible danger of the introduction of powdery scab from New Zealand into Australia can be eliminated. The collection of these data must naturally take some time, and the final decision of the Commonwealth authorities will apparently not be made until the fullest consideration has been given to all phases of the investigation. It is therefore obvious that prospects for the shipment of any of the present stored crop, even from the limited areas that are departmentally considered free from the disease, are very doubtful, especially as it is currently reported that there are sufficient Australian potatoes for the Commonwealth requirements.

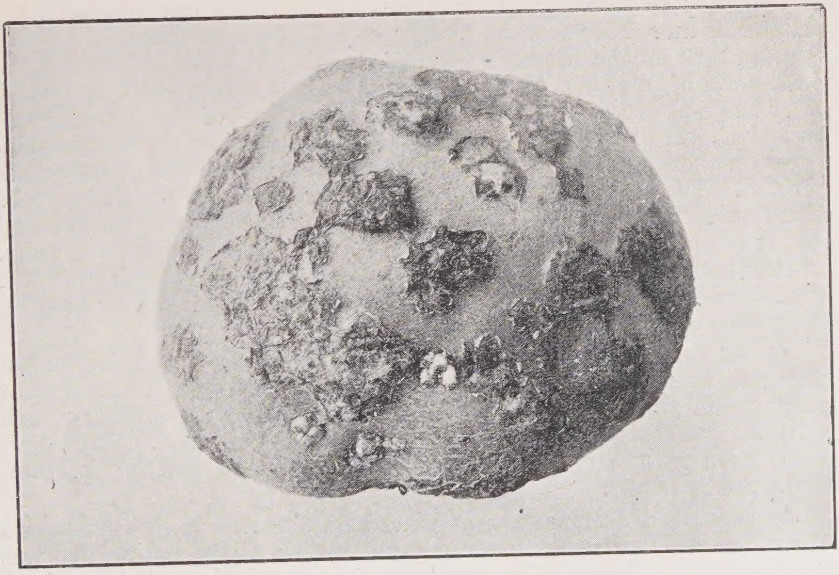
It will be well to here detail the main reasons that have been advanced by the Australian authorities in their contention that it is necessary to exclude the importation of New Zealand potatoes. They may be summarized somewhat as follows: (1.) Powdery scab is admittedly prevalent over certain of the main potato areas in New Zealand. (2.) The disease is not present in Australia at the present time. (3.) Many plant pathologists have declared that powdery scab is a dangerous disease. (4.) The fact that powdery scab is comparatively harmless in New Zealand is no criterion that if introduced into Australia it might not become a limiting factor in potato-production. (5.) The total prohibition of importation of potatoes from an infected country is the only satisfactory method of avoiding introduction into Australia of powdery scab. (6.) In order to build up an export trade in potatoes between Australia and the United States, Australia must not only be free of powdery scab, but must have an adequate quarantine against any country where the disease is known to exist.

From the foregoing it can be seen that the Australian authorities have, in their own estimation, no lack of good reasons why it is necessary to prohibit the introduction of New Zealand potatoes. It will now be well to give some consideration to the disease itself, and also to its position in the potato-growing industry of this country.

THE DISEASE AND ITS INCIDENCE.

Powdery scab is caused by a very lowly organism belonging to what are termed the slime fungi (*Myxomycetes*). This group of organisms, which in their vegetative characters have much in common with certain phases of animal life, and in their reproductive characters closely resemble certain of the true fungi, contains many well-known plant-

POTATO ATTACKED BY POWDERY SCAB (SPONGOSPORA SUBTERRANEA).
Showing ruptured pustules.



TUBER ATTACKED BY ORDINARY POTATO-SCAB (ACTINOMYCES SP.).

[*Photos, E. B. Levy.*

parasites. Amongst the most destructive of these may be mentioned club-root (*Plasmodiophora brassicae* Wor.) and black-wart disease (*Chrysophlyctis endobiotica* Schilb.). Powdery scab was first brought under scientific notice some seventy years ago, but to growers in Central Europe it was well known prior to that time under the popular name of *Kartoffelrande*. Since it was first named and described in 1841 powdery scab has had a most chequered career in the hands of many mycologists. To quote Dr. Pethybridge (First Report, "Potato Diseases in Ireland," 1910), "Not only has it changed its name several times, and been chased from one group of fungi to another, but it has been overlooked altogether and then been rediscovered and again renamed, till finally under this last guise (*Spongospora subterranea* (Wall.) John.) its presence in Ireland was first announced [by Johnson] about five years ago, although it has probably been here unrecognized for many a long year."

During the past decade very considerable attention has been given to powdery scab by plant pathologists, not on account of any increase in its destructiveness, but largely on account of its interesting botanical history, and owing to the fact that its presence had in many countries either been overlooked or confused with ordinary scab (*Actinomyces* sp.), a disease that is present in all potato-growing countries. Soon after the publication of Professor Johnson's original papers on the occurrence of powdery scab in Ireland it was found to be common in many countries, such as England, Scotland, Canada, the United States, and New Zealand, where previously its presence had been quite overlooked. It can very truly be said of powdery scab that its importance as a potato-disease can be traced rather to the work of the plant pathologist than to any actual damage it causes to potato-production.

Spongospora scab is generally quite easy to distinguish from ordinary scab by its more regular lesions, their frayed edges of upturned potato-skin, and the brownish powdery material with which the scabs are filled. Each grain of powder consists of what is termed a spore-ball, consisting of a sponge-like mass of spores. In the early stages of attack the lesions take the form of isolated pimple-like developments of the potato-skin. Later on these pimples or warts burst, leaving the powdery spore-mass exposed. The spores are scattered with great ease and are liable to be distributed throughout the soil where an infected crop is grown, and can, it is said, retain their vitality in soil for a period of several years. Distribution of the disease is readily occasioned not only by the transport of diseased tubers, but by means of infected soil, sacks used for bagging an infected crop, and by many other means.

So far as New Zealand is concerned the disease has been known positively to exist since 1909, but there is no doubt that it was present many years prior to that date, being confused with ordinary scab until the publication of its occurrence in Ireland in 1908. Since 1909 it has been frequently noted, especially in the more southern portions of the South Island.

As soon as the embargo was placed on the export of potatoes to Australia the Department made a rapid survey of the potato districts of Canterbury (Australian export being in general almost wholly from that province) in order to ascertain whether or not there were any districts wholly free from powdery scab. This investigation has shown

that there are localized areas where the disease cannot be found, but in nearly every case the boundaries of the clean areas or clean groups of crops are limited by areas where traces of powdery scab can be found. Thus, for instance, powdery scab is more or less prevalent over all the country south of the Ashburton River, while north of that boundary, except in the Yaldhurst, Styx, and Marshlands districts, near Christchurch, powdery scab is exceedingly rare, and over comparatively wide areas has not been found. As, however, free interchange of seed-potatoes has occurred for many years past, irrespective of whether they have been grown from a clean or diseased crop, it is possible that the disease may be found in isolated areas in those districts which departmentally are considered to be clean. It is not unlikely that the localized areas investigated by the Australian expert may be considered too small or too contiguous to diseased crops to allow the embargo to be lifted. Even if export is finally allowed from one or more of the present reputedly clean areas, this will not alter the fact that owing to the prevalence of the disease many of our main areas will not be in the same position.

THE QUESTION OF ERADICATION.

In consequence of this position it is necessary to consider whether some effort for the eradication of powdery scab from New Zealand should not be made. For myself, I am rather of the opinion that it will be recognized sooner or later in Australia that too much emphasis has been given to the dangerous character of the disease. Its presence in nearly all important potato-producing countries and the scant notice taken of it except in regions where it has not been reported present seem to indicate that its harmfulness has been enormously exaggerated. So far as New Zealand is concerned, were it not for the fact that it is banning export to Australia no notice whatever would be taken of the disease. In one of our most important potato areas it has been present for many years past without having had the least effect on the production or quality of the potatoes produced. When such a fact as this is considered it appears ridiculous to suggest that special methods of eradicating the disease are imperative. It may be contended, however, that ability to export potatoes freely to Australia is necessary both from the point of view of the grower and the consumer—in the one case to enable the profitable disposal of any surplus, and in the other so that adequate supplies at reasonable prices may be produced each year.

Thus, it follows that it is advisable to make an effort to eradicate powdery scab. The fact that even in districts where the disease is most prevalent only a very small percentage of the tubers become affected indicates that only a slight modification of practice might lead to eradication. Two factors that should lead to the rapid elimination of the disease appear to be obvious—namely, the use of disease-free seed only, and the growing of potatoes on the same land only once every seven years. It might be advisable also to avoid growing tomatoes on land that had been in potatoes during recent years, as there is experimental evidence that powdery scab can form nodules on tomato-roots.

One of the main difficulties with regard to disease-free seed is that in certain districts it might be impossible to secure seed from a crop

that is absolutely free from the disease. In such a case it would be advisable to dip all seed used in either 2-per-cent. bordeaux mixture or formalin 1 pint to 30 gallons of water. This would destroy all spores that might be on the surface of the tubers, but it is not always satisfactory where some of the spore-pustules have not burst open. I recognize that the dipping of potato-seed, where such a large quantity (15 cwt. or more) is used per acre is a troublesome operation, but it must be remembered that such treatment is effective against ordinary scab, which is, of course, a much more serious disease in New Zealand than powdery scab.

GRASS-GRUB CONTROL.

EXPERIENCE AT RUAKURA.

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A CASE indicating the efficiency of soil-trampling by heavy live-stock as a practical means of controlling attacks of the grass-grub (*Odontria zealandica*), in certain circumstances, has occurred at Ruakura this year.

In February last the wilting of large patches of grass pasture in one of the fields (No. 9) bespoke the active presence of the grub, and this was confirmed by examining the ground. Shortly afterwards a maize crop became available for feeding out to the dairy herd, and arrangements were made whereby this fodder was fed on the affected areas of the field. The result was a thorough trampling of the ground by the cows. Later on, during the winter, the same procedure was repeated with hay and mangolds. The grub-infested areas made a steady recovery from late autumn onwards, and by spring-time the grasses and clovers were growing almost normally on them. The process has been assisted by the germination of grass-seed shed from the hay when feeding and tramped into the ground by the cattle. The hay contained considerable quantities of clover seed-heads, and as clover-seed passes through cattle unharmed the establishment of clovers on the infested patches followed.

The concentration of cattle on these areas gave a further benefit, for in consequence the land received a heavy dressing of animal-manure. Subsequent to the stocking the land was chain-harrowed, thereby turning to profitable account the animal droppings.

The foregoing, however, does not comprise all the data. A control area, greatly increasing the value and interest of the demonstration, was automatically provided by a wire-fenced enclosure surrounding the soldier-trainees' quarters, which are situated in the field in question. Large parts of this enclosure were affected by the grub, including ground conterminous with grubby patches in the open field. The ground inside the fence was planted here and there with shrubs, and, of course, could not be subjected to the trampling process. On these enclosed patches the grass was practically killed out and the ground became bare.

It may be mentioned that in this case the rye-grasses were the first to suffer from the attack of the grub, while cocksfoot proved the most

resistant. Among the clovers, alsike and white soon succumbed, while red clover retained its roothold longest.

The trampling action of heavy cloven-footed beasts is great, especially with a herd moving about after fodder. This was borne out by an examination of the soil of the treated patches, which revealed numbers of crushed grubs, those that escaped having no noticeable effect. Such trampling is undoubtedly far more effective than rolling, where the pressure is distributed over a much larger area.

The method here outlined is not based on the results of one season's experience, for in the autumn of 1915 several acres of grassland infested with grass-grub received similar treatment, with the exception that turnips and mangolds only were fed out. Regrassing in this case was accomplished by the surface-sowing of grass and clover seeds and harrowing. Another field (No. 18) was badly infested with grass-grub during the autumn of 1918. Treatment on exactly the same lines as that given to field No. 9 and described in detail in this article destroyed the grubs and renovated the grass pasture. This is now one of the best pastures on Ruakura.

It is not claimed that the control plan here described could be carried out everywhere, or where the attack of the grub is widespread over the whole of the pasture of a farm. Attack, however, is very commonly confined to limited areas, and in such cases a simple adaptation of farm practice on the lines given will afford good prospects of successfully controlling the pest, especially in dairying districts where both cattle and fodder crops are available. Few dairy-farmers would wish to break up their best pastures in an endeavour to eradicate grass-grub by cultivation, which means that for the sake of dealing with comparatively small patches the whole of the field has to be ploughed up.

Farmers may be advised to especially watch for the grub on the lighter classes of land. The experience at Ruakura has been that the grub will be usually found in light loam, or loam over a gravel subsoil, rather than in heavy land with a clay subsoil. In the Auckland District the land varies considerably, and even in a comparatively small field the two extremes may be found. Such was the case in all the fields already referred to in this article. Patches of lighter land varying from 3 to 9 acres were affected, while the remaining areas of the fields varying from 12 to 21 acres were unattacked.

Returned Soldiers at Ruakura.—The quarters for soldier trainees at the Ruakura Farm of Instruction are now being doubled, enabling sixty men to be accommodated, compared with the present thirty. The new building will include a good-sized lecture-hall.

Sepsis in Dairy Cows.—In connection with the mortality from sepsis experienced in certain districts this season, farmers concerned may be reminded that this condition was dealt with and preventive measures described by Mr. A. R. Young, Director of the Live-stock Division, in the first article of his series on the "Management of Dairy-farm Stock," published in the *Journal* for August, 1919, pages 69–70.

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

VIII. AN EXPERIMENT IN CENTRAL OTAGO CONCERNING THE RELATIVE PALATABILITY FOR SHEEP OF VARIOUS PASTURE-PLANTS.

Dr. L. COCKAYNE, F.N.Z.Inst., F.R.S.

GENERAL.

THROUGHOUT this series of articles stress has been laid upon the importance of procuring reliable information regarding not only what pasture-plants are eaten by sheep, but the actual sequence in which they are eaten, the latter being termed their "relative palatability." The methods employed for determining such palatability are twofold—namely, (1) observing sheep feeding on the pastures and noting the plant or plants which have just been eaten and those other species in close proximity which are untouched, no evidence being accepted except the finding of the actual portion of the plant which has been bitten by the sheep; and (2) g azing an excessive number of sheep on a quite small area for a number of days, and taking careful notes regarding the sequence in which the various species are being eaten and the general effect upon the pasture of the grazing at certain periods throughout the experiment.

As the result of the actual field observations of grazing much evidence is accumulating, numerous observations having been made on the back-country sheep-runs throughout much of the South Island. These observations, when they reach a number amply sufficient to eliminate any errors of observation, will be tabulated and the results published in this *Journal*.

With regard to the experimental method it must be pointed out that the results of each experiment refer only to the actual locality where the experiment was conducted and to the conditions under which it was carried out—*e.g.*, the breed, age, and sex of the sheep; the time of year when the grazing took place; the state of the weather during the time of the experiment and for the particular year; the actual condition of the various pasture-plants at the time the experiment commenced; the kind of pasture the sheep had occupied prior to their being transferred to the experimental area; and the condition of the sheep at the commencement and the conclusion of the experiment.

Obviously the evidence derived from these palatability experiments can lay no claim to its general applicability; nevertheless, it is evident that it does suggest a good deal as to the nature and direction of further observations, and that it can be compared with the more natural field observations. Indeed, if the latter—taken as they are from the whole of the mountain sheep-runs—and the results of the experiments coincide, then an accurate knowledge of the relative palatability of the pasture-

plants—that fundamental basis for advance in the improvement of the runs generally—will be pretty nearly attained.

Prior to the experiment here being dealt with two other experiments had been carried out in connection with the montane tussock-grassland investigation. A detailed account of both has appeared in this *Journal* (June, 1919, and April, 1920). Suffice it to say here that the climatic conditions of Hanmer Plains, in the immediate neighbourhood of which the former experiments were conducted, are altogether different from those of the arid area of Central Otago. Also, the length of time allotted to these experiments was not long enough to enable a true estimate to be gained of the relative palatability of some of the pasture-plants. Nevertheless, certain points stood out clearly, and these become of greater interest when compared with the Central Otago results, since they tend to show that climates of an opposite character permit a similar degree of palatability for certain species. But this phase of the subject is to be dealt with in the next part of this series of articles.

In article II of this series (*Journal*, June, 1919, p. 322) I stated, "From what I have observed sheep do not take their food haphazard; they distinctly select—their feeding, indeed, may be called 'selective.'" The many field observations made since this was written strongly confirm this statement; so, too, does the Central Otago experiment. But the latter also shows that a certain species clearly proved to be of the highest palatability, such as cocksfoot, is occasionally neglected when species of undoubtedly lower palatability are present. Occurrences of this kind happen so rarely, however, that they may be considered negligible. Further, the relative palatability of a plant is especially demonstrated when it is eaten out of a pasture, while alongside these fully grazed plants, cropped close to the ground, remain in more or less abundance the plant or plants which on rare occasions were preferred. For a species named A to be of higher palatability than a species named B, A in a considerable number of cases must be eaten when B side by side with it remains untouched. If, however, A and B are plants of high though not of equal palatability, and they occur at considerable distances from one another—*i.e.*, they do not compete—then both may be eaten equally. Thus, while cocksfoot was being closely cropped in one part of the experimental area, the less palatable catsear was being eaten to the ground in another part.

From what has just been said an important question arises regarding plants of relatively low palatability—*i.e.*, whether such in the absence of species of higher palatability will be as good feed as the latter. The answer to this question can only be found out by experiment, and for this purpose small areas of pure pasture of the grass or herb to be tested must be provided. Such an experiment would prove whether or not a plant of low palatability—*e.g.*, blue grass (*Agropyron scabrum*)—capable of supplying abundant winter feed, might be introduced in quantity with advantage on to certain classes of winter country. On the other hand, it seems probable that the degree of palatability may stand in some relation to the degree of nutritive quality, so that the more palatable the more nutritious. Clements ("Plant Indicators," p. 286; Washington, 1920), using the evidence given by chemical analysis of many pasture-plants, considers that "differences in palatability are much more important than those of nutrition-content," and further states, "It is surprising to find some grasses which ordinarily are grazed

little or not at all possessing as high a nutrition-content as the best species of the range" [run].

In this account of the experiment full details regarding the palatability of each species occurring in the Earnscleugh area are not given, but such will form the subject of the next article of the series. Nor is a detailed account attempted of what happened day by day, since, owing to the nature of the plant-covering, such would be misleading without much tedious explanation. This plant-covering is far from uniform, as will be seen farther on, and as the sheep did not confine themselves to one spot, but grazed all over the area, different combinations of species with regard to palatability were being grazed on simultaneously; that is to say, species were being eaten in one place but neglected in another where more palatable species were present. Thus the account of the results, as given below, has been gleaned from a mass of evidence, which had to be sifted with great care.

THE CENTRAL OTAGO PALATABILITY EXPERIMENT.

The Experimental Area.

It is by no means easy to find suitable small enclosures for carrying out experiments in palatability. Fortunately, the Earnscleugh experimental area, near Clyde, though designed for a different purpose, is almost ideal. This area has been already described in this series of articles and details given of its plant-covering (*Journal*, February, 1920, p. 88). Here it need only be stated that the area was originally enclosed with a rabbit-proof fence in order to carry out certain experiments having a bearing on regrassing the depleted parts of Central Otago. Accordingly the lower part of the enclosure was cultivated and a considerable number of pasture-plants sown, some pure and in rows, and some as mixtures over wider areas. But the steepest portions of the ground were either let alone or surface-sown in places. The result has been that the cultivated portion of the land is now occupied by a rich vegetation, consisting chiefly of cocksfoot, lucerne, tall oat-grass, red fescue, and Chewings fescue. There is also a good deal of yarrow and sheep's burnet, and a fair amount of red clover and chicory. There are also a good many other grasses and herbs, but the names of these, English and scientific, may be seen in the list of species at the end of this article. Unfortunately, a good many of the species sown either did not germinate or have died.

In addition to these exotic plants, purposely introduced, others have come unbidden, together with a number of indigenous species, denizens of the original grassland, the most important being blue-grass and tall blue-tussock. Altogether, counting those species which could be reached by the sheep, there were about eighty species available for testing their relative palatability.

The original enclosure had an area of about 20 acres, but in order to provide water for the sheep about half an acre, which takes in part of a running stream (Picnic Creek), has been added.

As one of the special objects of the experiment was to discover the true palatability values of certain indigenous grasses, when not competing with plants of known higher palatability, an area of $\frac{3}{5}$ acre, containing a good many plants of the species to be tested, was fenced off from the remainder of the area (see Fig. 1). In what follows this is called "the small enclosure."

FIG. 1. CENTRAL OTAGO PALATABILITY EXPERIMENT: THE SMALL ENCLOSURE ON EARNSCLEUGH AREA.

Showing great abundance of catsear in foreground and centre.

FIG. 2. PART OF EARNSCLEUGH AREA.

On left, portion of depleted ground added to the area by removal of fence. On right, part of cocksfoot slope before the experimental grazing commenced.

[*Photos, W. D. Reid.*

Soil, Climate, and Condition of the Vegetation.

The soil is that rich mica-schist soil so characteristic of Central Otago. Apart from the level ground adjacent to the lower fence the condition of the soil is governed by the degree of slope and the aspect. The upper soil of the level ground consists of a fine black loam, 5 in. to 6 in. deep. The subsoil—10 in. in depth—is a rather stiff clay overlying a bed of coarse sand intermingled with many small stones. On the hillside the more gentle the slope the greater is the depth of humus and freedom from stones, but aspect plays a notable part, so that the depth of the upper soil on sunny faces is much less than that on semi-shady and shady faces. The nature of the subsoil for all the slopes is fairly constant. It varies in depth from 8 in. to 2 ft., and at a depth of 12 in. is coarse, sandy, and mixed with broken stones; at a greater depth large boulders are present. On sunny faces humus is absent in many places. On the eastern and south-eastern slopes there is good black loam, 4 in. deep, and more or less free from stones. There are a good many outcrops of rock, especially on the higher parts of the area.

Owing to the extremely steep character of so much of the surface only a continuous rain can sink into the soil for any distance. Apart from lucerne, sorrel, and certain shrubs, few of the species send down their roots more than 2 ft., at which depth during summer the soil is extremely dry. Such dryness of the soil is not to be wondered at, for the average annual rainfall of the neighbourhood is only some 14 in., and the average number of rainy days sixty. In 1919–20, up to the time the experiment commenced, there had been a prolonged period of drought, hardly any rain having fallen since October, 1919. Moreover, the summer was excessively hot, no less than 100° F. having been registered in February, while 90° F. and over had not been uncommon.

From what has been said in the last two paragraphs it is clear that the vegetation should have reached its maximum condition of dryness. But in this respect the state of the plants was not uniform throughout the area—an excellent circumstance in view of the experiment. In a good deal of the sown area the lucerne, cocksfoot, tall oat-grass, and certain other plants had been cut for hay before Christmas, such cut plants in their young growth offering a different test for palatability to the old, uncut plants with their hard stems, many of which plants had grown unmolested for eight or nine years. Then, on one of the steep slopes there had been a grass-fire some two years before, and the burnt tussocks had grown very slowly and their leaves were more succulent than those of the unburnt tussocks. Certain species also offered a different class of feed according to their aspect with regard to sun and shade. Finally, young and old plants offered a different class of feed. Thus, although there were only eighty species, these represented far more than that number so far as relative palatability was concerned.

The stems of the old uncut lucerne, tall oat-grass, and cocksfoot were very hard and dry; meadow-grass and rye-grass were generally almost completely burnt up, and their dry brown leaves looked most unpalatable; indeed, excepting the three indigenous tussock-grasses, the plants as a whole differed greatly in appearance from the same species growing in a locality with a reasonable rainfall. But this was all the better for the test, since in arid Central Otago dried-up foliage and hard stems are the rule in summer. If exotic grasses and herbs

FIG. 3. FESCUE-TUSSOCK (COMMONEST TUSSOCK-GRASS OF THE SHEEP-RUNS) REMAINING UNEATEN AT CLOSE OF EXPERIMENT.

FIG. 4. COCKSFOOT AND OTHER PLANTS SHOWN IN FIG. 2 AT CONCLUSION OF EXPERIMENT.

Had the sheep been kept longer on the area the remaining dry cocksfoot-stems shown in photograph would have been eaten.

[*Photos, W. D. Reid.*

are to be substituted for those which are indigenous, they must be judged from their summer condition in a dry climate, for their palatability under ordinary circumstances in wetter localities can be no criterion as to their value in arid, depleted areas.

The Actual Experiment.

It has already been explained that the pasture on which the sheep were to be grazed was far from uniform in its composition. The following were its most distinct types of vegetation: (1) The sown area, much of which, before Christmas, had been cut for hay; (2) the sown but uncut area, to be subdivided into the cocksfoot slope (see Fig. 2), and the Chewings fescue bank; (3) the unsown catsear area; and (4) the indigenous-tussock area. Throughout these areas were many patches, some fairly large, where certain species occurred in quantity—*e.g.*, yarrow, sheep's burnet, chicory, meadow-grass (*Poa pratensis*), red-top, Yorkshire fog, and red clover. Other plants occurred in but few places—*e.g.*, sainfoin (*Onobrychis viciaefolia*), birdsfoot trefoil (*Lotus corniculatus*), alsike (*Trifolium hybridum*), twitch (*Agropyron repens*), and woodrush (*Luzula campestris* var.—indigenous). The indigenous tussocks, though occurring principally on the dark faces, were also here and there side by side with the specially palatable species, while a row of fescue-tussock had been established from seed in the cultivated portion of the area (see Fig. 3).

The sheep used in the experiment were kindly lent by Mr. J. Faisandier, whose orchard and farm is in close proximity to the experimental area. The sheep were therefore merely moved, as it were, from one paddock to another. They numbered three hundred, and consisted of crossbred ewes and lambs. Previous to their being put on the area they had been grazing for a considerable time on an irrigated pasture consisting of (in order of relative abundance) meadow-grass, white clover, crested dogstail, rib-grass, catsear, and cocksfoot. At the time the experiment commenced the sheep were in fair condition, and at its conclusion were in the majority of cases in better condition than when the experiment commenced. Therefore, throughout the experiment there was no time when there was not abundance of feed at the disposal of the animals. Even on the last day the cocksfoot slope was far from being eaten bare (see Fig. 4).

On 20th February, 1920, shortly after 10 a.m., twenty of the sheep were put into the small enclosure, and an hour and a half later the remaining 280 sheep were turned on to the remainder of the pasture. Notwithstanding that the sheep had been suddenly transferred from a green irrigated paddock to the burnt-up vegetation of a dry hillside they commenced feeding heartily at once. This may be partly accounted for by the fact that though not really hungry they had not been getting an abundant allowance of food. Those in the small enclosure made a beginning on the dry seed-stalks and seed-heads of the catsear (see Fig. 1), while the remainder of the sheep remained on the sown area and confined their attention to the lucerne and cocksfoot. Other species eaten to some extent the same day on this last-named area were red clover (the seed-pods), catsear, and sheep's burnet.

On the second day, in addition to the foregoing species, which were still being eaten freely, birdsfoot trefoil, sainfoin, alsike (the seed-pods),

FIG. 5. SHEEP EATING YARROW IN PRESENCE OF LUCERNE, BLUE-GRASS, AND TALL OAT-GRASS.

FIG. 6. CHEWINGS FESCUE (ON RIGHT) NOT EATEN, BUT COCKSFOOT AND LUCERNE (ON LEFT) EATEN TO GROUND.

Later the fescue was eaten closely. [*Photos, W. D. Reid.*

and dry, thick stems of lucerne were eaten. In the small enclosure the sheep continued feeding on the catsear, but an occasional nibble was made at a blue-grass tussock.

On the third day a few sheep left the sown ground and ascended to the summit of the area, but throughout the experiment by far the greater part remained on the sown area, although enough visited the catsear slope to finally entirely dispose of that plant, though most abundant, and leave the ground quite bare.

On the fourth day yarrow was eaten (see Fig. 5), and so greatly was this enjoyed that in a few days not merely were the leaves and erect stems disposed of, but the underground stems were laid bare. Strange to say, the dry portions of the plant were greatly preferred to the green.

By the eleventh day—leaving aside what happened in the small enclosure—the extent to which the species had been individually grazed was as follows :—

Cocksfoot : Where cut it had been closely eaten. The uncut plants on the hillside had been reached by the sheep on the sixth day, but though eaten continuously a large amount of both green and dry growth remained.

Lucerne : Where cut it had been greatly eaten. Uncut plants had been stripped of leaves ; the upper parts of the stems had been eaten, but the lower parts of these still afforded food.

Red clover : By the eighth day all this had been eaten, but it must be remembered there was not a great deal originally.

Catsear : This had been greatly eaten, especially after rain, but there still remained a good deal.

Yarrow : All except the green leaves and young growth was eaten by the ninth day.

Sheep's burnet : The stems had been stripped of their leaves, but young growth was still supplying feed.

Alsike : Seed-heads, stems, and leaves had all been eaten.

Chicory : The erect stems had been stripped of leaves, but a small amount of growth at the base of the stems still supplied food.

Yorkshire fog : Green plants in the more shady places had been eaten, but in exposed positions the plant had not been eaten to any extent.

Woodrush : The leaves had been eaten closely.

Sowthistle : Both stems and leaves had been closely eaten.

Rib-grass : The leaves had been eaten close, but the flower-stems and seed-heads had not been eaten.

Chewings fescue : A good deal had been eaten, but it must be borne in mind it did not compete with lucerne and cocksfoot. Where it did so compete it was not eaten until the two last-named species were disposed of (see Fig. 6).

Red fescue : It was only where this formed a pure pasture that it was eaten.

Sainfoin : The few plants had been stripped of leaves, but the stems were untouched.

Birdsfoot trefoil : Leaves and young growth had been eaten, but not the old stems.

FIG. 7. COCKSFOOT TUSSOCKS (IN CENTRE) EATEN TO GROUND.

The tall tussocks, remaining at end of experiment, are tall oat-grass and the two kinds of canary-grass.

FIG. 8. TALL BLUE-TUSSOCK EATEN IN THE SMALL ENCLOSURE.

[*Photos, W. D. Reid.*

Sorrel: This is not a common plant of the area; it had been eaten very little.

Sweet vernal: Where green a small amount had been eaten.

Red-top: The seed-heads in a few instances had been eaten.

Rye-grass: This had been eaten to a very limited extent if there were green leaves.

Meadow-grass: This was extremely dry; where there were a few green leaves they had been eaten.

White clover: The few plants had been only partly eaten.

Tall oat-grass: This had been very lightly grazed, but the general effect was not noticeable (see Fig. 7).

Blue-grass: Although this was being eaten the bulk of the fodder had been reduced only to a very limited extent.

Hawksbeard: Up to the time in question only the seed-heads had occasionally been eaten.

Tall blue-tussock: Only young plants had been eaten.

Smooth-leaved mullein: A few plants showed signs of having had their leaves eaten.

Vetch: This had been eaten only to a slight extent.

The following species had not been eaten: Winged thistle, twitch, sterile brome-grass, soft brome-grass, piripiri, wild-irishman, sweetbrier, pink willowherb, common dock, plume-grass, fescue-tussock, and the two species of *Phalaris*.

When the specially palatable feed on the sown area was consumed more sheep grazed on the slopes, and, though that covered with cocksfoot was the favourite place, sheep visited all the other parts of the area. In consequence, various plants of medium and low palatability had few or no competitors, and so were eaten more or less. In this category came the following: Dry meadow-grass (*Poa pratensis*), eaten close; blue-grass, often eaten to the base, but more frequently only partly eaten; tall blue-tussock, not nearly eaten to the same extent as blue-grass; twitch, especially where it had been cut; the two fescues, but the smaller one more especially; green Yorkshire fog; one of the hooked sedges (*Uncinia*); a dwarf sedge (*Carex Colensoi*); dry winged thistle; young fescue-tussock.

Coming now to what happened in the small enclosure of $\frac{3}{5}$ acre in extent, early in the experiment three of the twenty sheep confined on this area jumped over the fence. On the eleventh day the sheep were let out in order that they might go to the water, and the next day forty-four sheep were put on to the area and kept there for five days.

The species of the small enclosure were the following: Catsear (very abundant—see Fig. 1), Yorkshire fog (plentiful), blue-grass and blue-tussock (abundant), dried up annual fescue (a fair amount); and, in a small amount (very little in some cases) hawksbeard, cocksfoot, woodrush, dry winged thistle, piripiri, hair-grass, desert-broom, soft brome-grass, barley-grass, sweet vernal, sweetbrier, sorrel, common dock, and fescue-tussock.

By the tenth day the following had occurred: Catsear had been eaten greatly, but there was still a large quantity; the young leaves of Yorkshire fog had been eaten, but the dry parts were untouched; blue-grass was eaten to a small extent; tall blue-tussock was eaten much less than blue-grass; rye-grass (dry) was only lightly eaten; sweet

vernal was eaten slightly; desert-broom was eaten slightly. The remainder of the species were apparently untouched.

With the increase of the sheep to forty-four the grazing became more intense. A good many tussocks of blue-grass were closely cropped; catsear was eaten out completely; desert-broom was much more freely eaten; burnt tall blue-tussock and blue-grass were both eaten to the ground; some tussocks of blue-grass were closely eaten, but many were not eaten at all; tall blue-tussock was eaten at times (see Fig. 8); dry winged thistle was eaten fairly heavily; heads of sweet vernal lay uneaten on the ground.

At the end of this palatability experiment, except on the cocksfoot slope, all the plants of high palatability were eaten close, but many were making considerable growth, a sign that for the time being the pasture had not been overstocked. The plants of medium palatability were also mostly cropped close. Certain species had the leaves eaten but not the dry stalks—*e.g.*, the two kinds of fescue. Tall oat-grass, canary-grass, and fescue-tussock were hardly eaten at all. The latter remained untouched either in the presence of blue-grass or of blue-tussock, or when all the competing plants in the vicinity had been eaten to the ground (see Fig. 3). A list of the plants apparently not eaten at all will appear in the next article of this series.

LIST OF SPECIES GROWING ON THE EARNSCLEUGH EXPERIMENTAL AREA.

The sign * attached to a name indicates that the species is indigenous.

Scientific Name.	Popular Name.
1. Grasses and Grasslike Plants.	
**Agropyron repens*	Twitch.
—— *scabrum*	Blue-grass.
Agrostis tenuis (vulgaris)	Red-top.
Aira caryophyllea	Hair-grass.
Anthoxanthum odoratum	Sweet vernal.
Arrhenatherum elatius	Tall oat-grass.
Bromus hordeaceus (mollis)	Soft brome-grass.
—— *sterilis*	Sterile brome-grass.
**Carex resectans*	Desert-sedge.
—— *Colensoi*	
Dactylis glomerata	Cocksfoot.
Dichelachne crinita	Plume-grass.
Festuca gigantea	Giant-fescue.
—— *myuros*	Annual fescue.
*—— *novae-zelandiae*	Fescue-tussock.
—— *rubra* var.	Red fescue.
—— ,,	Chewings fescue.
Holcus lanatus	Yorkshire fog.
Hordeum murinum	Barley-grass.
Lagurus ovatus	Harestail-grass.
Lolium perenne	Rye-grass.
**Luzula campestris* var.	Wood-rush.
Phalaris bulbosa	Bulbous canary-grass.
—— *commutata*	Canary-grass.
Poa annua	Annual poa.
*—— *intermedia*	Tall blue-tussock.
*—— *maniototo*	Desert-poa.
—— *pratensis*	Meadow-grass.
**Scirpus cernuus*	Nodding club-rush.
**Triodia Thomsoni*	Otago triodia.

LIST OF SPECIES—*continued.*

Scientific Name.	Popular Name.
2. Herbs and Semi-woody Plants.	
**Acaena Buchanani*	Pale piripiri.
**—— novae-zelandiae*	Red piripiri.
**—— Sanguisorbae* var. *pilosa* ..	Mountain-piripiri.
Achillaea Millefolium	Yarrow.
**Aciphylla Colensoi*	Spaniard.
Anagallis arvensis	Scarlet pimpernel.
**Blechnum penna marina*	Alpine hard-fern.
Carduus pycnocephalus	Winged thistle (usually called "star-thistle" in Central Otago).
Cerastium triviale	Larger mouse-ear.
**Cheilanthes Sieberi*	Common lip-fern.
Cichorium Intybus	Chicory.
Crepis capillaris (virens)	Hawksbeard.
**Epilobium cinereum* var.	Pink willowherb.
**—— nerterioides*	Wrinkled willowherb.
**—— pedunculare* var.	Long-stalked willowherb.
**Erechtites quadridentata*	White fireweed.
Erodium Cicutarium	Hemlock-storksbill.
**Galium umbrosum*	New Zealand bedstraw.
**Geranium sessiliflorum* var. *glabrum* ..	Short-flowered cranesbill.
Hypochoeris radicata	Catsear (frequently called "capeweed," and often mistaken for dandelion).
Lotus corniculatus	Birdsfoot trefoil.
Marrumbium vulgare	Horehound.
Medicago maculata	Spotted burr-clover.
—— *sativa*	Lucerne.
Myosotis (species not yet identified) ..	Forget-me-not.
Onobrychis viciaefolia	Sainfoin.
**Oxalis corniculata*	Yellow oxalis.
Plantago lanceolata	Rib-grass.
**Polystichum Richardi*	Hard shield-fern.
Poterium Sanguisorba	Sheep's burnet.
**Raoulia Beauverdii*	Otago raoulia.
**—— lutescens*	Scabweed.
Rumex Acetosella	Sorrel.
—— *crispus*	Curled dock.
**Solanum nigrum*	Black nightshade.
Sonchus oleraceus	Sowthistle.
**Stellaria gracilenta*	Mountain-chickweed.
Trifolium hybridum	Alsike.
—— *pratense*	Red clover.
**—— repens*	White clover.
Uncinia (species not yet identified) ..	Hooked sedge.
**Urtica aspera*	Mountain-nettle.
Verbascum Blattaria	Smooth-leaved mullein.
Vicia (species not yet identified) ..	Vetch.
3. Shrubs.	
**Carmichaelia Petriei*	Thick-stemmed broom
**Coprosma propinqua*	Common coprosma.
**Discaria toumatou*	Wild-irishman (usually called "matagouri" in Otago).
**Hymenanthera dentata* var. *Alpina lupinus arboreus*	Tree-lupin.
**Olearia odorata*	Odorous tree-daisy.
Ribes Grossularia	Gooseberry.
Rosa Eglanteria (rubiginosa) ..	Sweetbrier.
**Rubus subpauperatus*	Narrow-leaved lawyer.

TOPICAL NOTES ON SOME DISEASES OF LIVE-STOCK.

A. R. YOUNG, M.R.C.V.S., Director of the Live-stock Division.

CONTAGIOUS ABORTION IN CATTLE.

THIS troublesome and well-known disease has caused immense losses in New Zealand as in other affected countries, but it does not by any means appear likely to become so great a scourge here as in some other lands. The position, however, is serious enough to warrant us in considering every possible means likely to bring about the eradication of the disease, and there is no doubt that the sanitary methods adopted by farmers in the past have been the means of keeping it considerably in check. Contagious abortion has been the subject of research work in up-to-date laboratories all over the world, and our knowledge of the disease is slowly but surely advancing in a direction likely to lead to its ultimate eradication.

It has been suggested by farmers' organizations that legislation should be enacted to restrict the sale of cows which have recently aborted, but great difficulties present themselves in this connection. In the first place, an animal may abort without the aid of the germ of the contagious form. The majority of affected cows abort in from two to seven months after conception, yet it has been pointed out that many cows carry their calves the full period although they are harbouring the contagious germ and are still capable of spreading the disease to other animals. It will be recognized, therefore, that if such legislation were hastily adopted many great difficulties would arise and hardship occur. At the present time it would practically mean that no one could sell a cow without first having a small quantity of its blood examined by a bacteriologist. As this process is a somewhat complicated one much delay might occur, and no action could be taken against any one for exposing for sale any animal suspected of this disease without this test being applied. A simple way out of this difficulty would be to frame a clause to cover any cow which has aborted within the gestation period; but the objection to this is that it would include all abortions from whatever cause and yet, as already indicated, not absolutely prevent the sale of some animals harbouring the germ of contagious disease.

Many valuable additions to knowledge concerning contagious abortion have been made within recent years. It can now be fairly accurately determined by bacteriological examination of the blood of an animal whether it is harbouring the germ of the disease or not. It has also been determined that the contagious germ is migratory—that is, when the animal is pregnant the germs are to be found inhabiting the genital organs, and when non-pregnant they are almost exclusively found in the udder and adjacent lymphatic glands. Further, there are indications that at no great future date a perfect system of vaccination or inoculation will be found which can be practically applied in this country, but at the present time this form of prevention is not sufficiently out of the experimental stage to be of practical value under our conditions.

Here the conditions of housing and milking are very different from those of Britain, where the tests have been applied and a certain degree of success claimed. These tests, however, require careful examination regarding their results, as it is a well-known fact that in some herds contagious abortion disappears to a considerable extent without any treatment whatever, and with a herd so tested no doubt the favourable results would have been placed to the credit of inoculation. These experiments are being carefully watched and tests made at the Department's veterinary laboratory, consideration always being given to the practical side of the matter.

Another principle recently advocated, and apparently practised with success, is that of acquired immunity. Large stockowners, recognizing that any treatment whatever was almost wholly outside the sphere of practical application, went to the other extreme and decided to keep all aborting cows together and breed from them, only introducing new blood when absolutely necessary. They claim that by doing this they have considerably reduced their losses from contagious abortion, as the animals appear to become immune from the disease.

These remarks bring one to the question, What is best to be done by the farmer pending the adoption of new methods? It can be gathered from the information already acquired that the only time in which the washing-out of the genital organs of cows is of any effect is immediately after calving. Moreover, every measure for cleanliness and sanitation should be adopted, so that the contagious germ may be reduced as far as possible. After impregnation the usual sanitary methods in connection with the external parts should be continued as formerly advised. (See *Journal*, June, 1918, page 329.)

BLACKLEG.

Blackleg was probably introduced into this country through the agency of unsterilized bone manure, and made its appearance simultaneously at two points far apart, one being near Tikorangi, in Taranaki, and the other close to Auckland. The results, so far as Taranaki is concerned, are well known. In both districts the spread of blackleg was principally through the agency of the saleyards. In Taranaki the disease has been confined to a well-defined area. This success was principally due to taking in under the quarantine regulations a large area of clean country on the outskirts, and as soon as it was found that we were outside the trouble these boundaries were somewhat contracted. In the Auckland District the position is somewhat different, as it is most difficult to secure a natural boundary of any value. Fortunately, the great success of vaccination has saved the farmers large numbers of stock from this disease, and as the vaccine is prepared at the Department's laboratory at Wallaceville the expense of administration is not very great.

One very important point regarding blackleg (and anthrax) should always be kept in view, and that is that once a farm has become infected it may continue to be a danger-ground, even for a period of five or seven years afterwards. Therefore, while the farmer may for two or three years have had successful vaccination and no deaths, he should still continue to have his cattle vaccinated, so as to prevent any further disease from this cause. Unfortunately, there have been a few outbreaks where the disease had not been in existence for a year or two. In these cases, however, upon the land changing ownership

the incomers were not aware that blackleg had ever existed upon the place, with the result that some of their stock died of the disease before vaccination. The year or two for which these farms were free from disease was absolutely lost by its reintroduction, and there is no doubt in my mind that blackleg will never be stamped out upon any farm unless the utmost care is taken that no outbreaks are allowed to occur from lack of vaccination. Further, if a death occurs, not only should the animal be deeply buried, but all the surface soil contaminated by the carcase should be thrown into the bottom of the hole.

SOME OUTSIDE DISEASES: IMPORTATION PRECAUTIONS.

Anthrax, a deadly disease and one which affects all animals, was introduced into New Zealand some years ago (also through unsterilized fertilizers of animal origin), but the prompt action then adopted, and the measures taken to prevent its reintroduction has placed the Dominion in the position of having been absolutely free from this disease for the past fourteen years.

A cattle-disease which requires careful watching—not having been introduced into this Dominion—is what is known as worm nodules. This parasite affects the muscles of cattle to such an extent as to cause serious losses in the beef product.

The gad or warble fly is another pest which is carefully watched for when cattle are being introduced. As the development of the warble when the animals arrive is very uncertain, not only has the quarantine period to be enforced, but long after the animals have been discharged the owners should carefully examine them for all evidences of warbles upon the back, and not only squeeze them out when almost ripe, but see that they are destroyed. They will be reminded of this necessary attention by periodical visits from the local Inspector of Stock for some time after the cattle have reached the owner's farm.

The best strain of milking-goats which can be procured in Great Britain is shortly being imported into the Dominion by the Department and also by a private owner. The blood of each of these animals will have to be microscopically examined in quarantine, as goats suffer from a blood-parasite which is also communicable to the human subject. As far as we know, this disease has never been introduced into New Zealand. It is therefore of the utmost importance that it should be kept out. Even dogs from some countries are debarred because it is well known that they harbour a blood-parasite which is capable of being conveyed to other animals.

There are many other serious contagious diseases, such as foot-and-mouth disease, rinderpest, rabies, pleuro-pneumonia, glanders, &c., which have been kept out of the Dominion by the regulations governing the introduction of stock and by those requiring the pre-sterilization of imported animal manures. Sometimes the Department is blamed for being too strict in the administration of these regulations, especially when debarring the introduction of new blood into the Dominion from certain countries; but no new blood, however valuable, would ever compensate for the great loss and inconvenience the country would suffer should any of these highly dangerous diseases be introduced. While the Department sympathizes with breeders in their endeavour to secure fresh breeding-stock, the interests of the Dominion as a whole must have first consideration.

IMPROVEMENT OF POOR PASTURE.

THE WALLACEVILLE EXPERIMENTS.

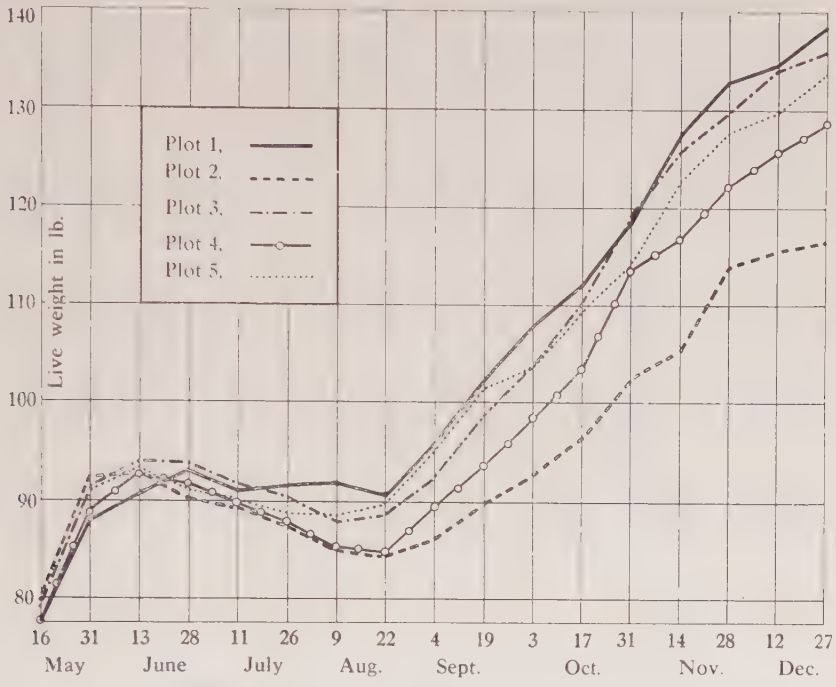
B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

In the issue of the *Journal* for January, 1919, the writer gave the results of a series of pasture-improvement experiments at Wallaceville with poor flat "black-birch" (*Fagus Solandri*) country, a shallow soil resting on a gravel and boulder subsoil. Since Wallaceville is adjacent and has similar soil to that of the Trentham Camp, with which many thousands of New-Zealanders have been made familiar, it is not intended to recapitulate anything further concerning the soil and pasture which has been used in carrying out the experiments. It will suffice to say that the object is to determine the best method of improving poor shallow unploughed flat danthonia pasture, which naturally yields its best pasturage in wet seasons, which dries up in dry seasons and summer to a dangerous degree, and which is subject in the winter months to the severity of climate which characterizes an inland situation at the altitude of the Upper Hutt plain. Alteration in the pasture due to the treatment has been gauged by the fortnightly weighing of the animals pastured thereon, with the exception of the temporary cattle or horses, which were put on from time to time in order that the pasture might derive some of the benefits which are so well known to accrue from mixed grazing, involving the removal of rank herbage unpalatable to sheep, with the consequent replacement of more acceptable food.

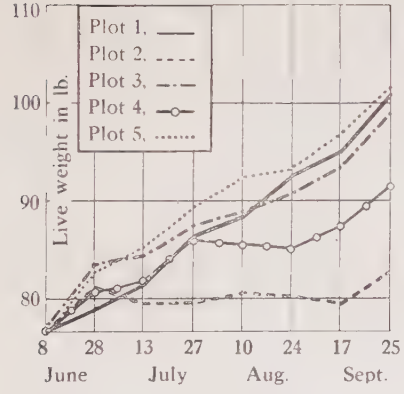
By means of efficient management* in the grazing and the judicious top-dressing with suitable substances it is hoped to improve the sward of grasses and clovers, so that the maximum grazing-capacity may be attained through the years. A somewhat significant fact was impressed on the writer by a casual observation made some months ago. On the limestone-treated paddocks a number of large stones of white limestone were spread over each paddock in 1915, and remained conspicuously visible for two or three years, owing to their colour being quite a contrast to the other stones. It is now difficult to find any of these stones, owing to the fact that they are slowly sinking out of sight. Those who care to follow the matter further as to the scientific reasons for this should consult Darwin's book on "Earthworms." Examination of the larger stones remaining showed that they are sinking at a rate which is comparable with that given by Darwin, and no doubt it is only a question of time when they will be completely covered with turf. This observation prompts the idea that the natural improvement of all flat, stony, grassed and grazed country must be much more rapid than most people imagine. The action of earthworms in bringing up castings and enabling stones to sink and the surface to become covered with soil must be improving this type of land irrespective of aid from manurial dressings of an artificial nature.

* Mr. J. Evans, Farm Overseer, has continued his valuable assistance, as in previous years, in this respect.

1919.



1920.



The quantities and dates of the different top-dressings on the five 5-acre paddocks are as follows: No. 1, 5 cwt. basic slag, applied February, 1919; No. 2, control (no treatment); No. 3, 3 tons limestone rubble and 5 cwt. Makatea phosphate, applied 1915; No. 4, 3 tons limestone rubble, applied 1915; No. 5, 5 cwt. Ephos basic phosphate, applied 1915.

The upper graph shows the fortnightly weighings of the sheep on the respective experimental paddocks from May to December, 1919. The lower graph shows similar weighings from June to September, 1920.

Ten sheep were grazed for weighing purposes on each of the five 5-acre paddocks between the dates specified, but, in addition, during the flush period in early summer extra stock were grazed on all except the control paddock. During the intervening periods—when experimental grazing and weighing were in abeyance—the areas were well stocked with sheep, cattle, and horses.

These experiments, it should be noted, are not conducted on meadows or hayfields which it is possible to plough and therefore to improve by rotation or by sowing with more nutritious grasses. The Wallaceville land is essentially pasture land, and the experiments conducted on it are therefore of a unique type.

One of the most important facts demonstrated, and one which has a peculiar interest for farmers at the present moment, is the excellent result given by ground mineral phosphate rock from Makatea Island, which is so similar in chemical composition to Nauru Island phosphate as to be practically identical with it. On one of the paddocks Makatea phosphate was used in conjunction with limestone, and although in point of fineness the phosphate was not all that could be wished* the results have been eminently satisfactory, and point to the fact that this type of high-grade mineral phosphates may be relied upon to give good results on land which responds to phosphate and which has a similar rainfall. In view of the large amounts of high-grade Nauru Island phosphate which will shortly become available for New Zealand farmers it is strongly urged that it be used for top-dressing pastures in the finely ground condition without any admixture of other fertilizers, and used in conjunction with lime if necessary. In this way nitrogen will be further accumulated in the soil by the clovers and plant residues, and thus the necessity for this most expensive ingredient in artificial fertilizers be dispensed with. There only remains potash to be considered, and the writer's advice to pastoralists is to experiment with small areas, and determine to what extent improvement may be effected by the use of this at present costly substance. With a prospect of supplies cheapening it will be better at present to confine the use of the potash salts to purely experimental areas.

The marvellous effects of basic slag on Wallaceville pasture may be briefly alluded to. A paddock (No. 1) which was dressed with an equivalent money value of finely ground carbonate of lime to the coarse unground limestone in 1915 proved to have such an inadequate amount that it was regarded merely as a duplicate control paddock. It was therefore decided to top-dress it with basic slag, which was accordingly applied at the rate of 5 cwt. per acre on 25th February, 1919. The response of the pasture was almost magical, and the beneficial results are shown on the live-weight gains which the sheep made on the slagged paddock compared with the control plot. A writer in the *Journal of the Ministry of Agriculture* (British) for May, 1920, on the use of slag had a similar experience. He states that the application of basic slag to a plot on 13th June wrought "a marvellous transformation," and adds, "It is commonly said that basic slag requires time and plenty of rainfall before any effect can be seen, but by the August weighing, eight weeks afterwards, the change in the appearance of the plot was quite evident, and all through the following two months perfectly remarkable, plenty of healthy-looking small clover herbage all over the plot. It was most interesting to observe how the sheep immediately bore witness to the improvement." Then, New Zealand readers should carefully note what at the end of the same article this

* Only 49 per cent. passing through a 100-mesh sieve and 95 per cent. passing a 30-mesh sieve, whereas the fineness of ground mineral phosphate should be at least equal to that demanded for basic slag—viz., 75–90 per cent. to pass through a sieve with 100 meshes to the linear inch (or 10,000 to the square inch).

writer states: "In rainy districts and on sour soils ground mineral phosphate is practically as good as slag." The North Island reader will not be disposed to dispute the applicability of the above terms to the climate and soil of at least those portions of the Island which are outside of Hawke's Bay.

It is not now intended to dwell further on the matter in this respect except to point to the lasting effect of phosphate and limestone dressings in these Wallaceville experiments, which have now been running for five years. The results warrant the close attention of all who have similar poor country which it is desired to render more productive. Paddocks 2, 3, and 4 are strictly comparable in all respects, but paddock 1, as has been stated, was dressed much later than the others with slag, while paddock 5, with Ephos phosphate, is rather more favourably situated than the other paddocks, as it has the advantage of some "birch" forest, which provides shelter in cold windy weather.

A further contribution will be made in a later issue of the *Journal*, in which the 1920 grazing results, which are at present in progress, will be given in full, and the whole of the results then discussed fully. In the meantime two graphs are published, representing the results in mutton-production for 1919 and part of 1920.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. JERSEY LIST TO END OF SEPTEMBER.

W. M. SINGLETON, Assistant Director of the Dairy Division.

SINCE the end of the first half-year, when the last list was published, certificates have been forwarded in comparatively large numbers to testing breeders. A complete list for all breeds would be too lengthy for one issue of the *Journal*. The list for Jerseys is therefore published in this issue, and it is intended to similarly report the records for Friesians, Ayrshires, and Milking Shorthorns next month.

The present list of Jerseys contains two new class-leaders. Aster's August Child, owned and tested by Mr. James Nicolson, of Kaupokonui, constitutes a new leadership record for the junior two-year-old class, at 689·05 lb. butterfat. As a matter of fact this heifer commenced her test as a yearling, being only 1 year 337 days old at the time of calving. She displaces Mere, who was tested by Mr. F. S. McRae, of Palmerston North, and as a yearling produced 663·64 lb. butterfat. Mere's at the time was a world's record, but has since been surpassed to an extent that although Aster's August Child has beaten Mere's record the new class-leader's record does not carry a world's championship. The record of Aster's August Child, nevertheless, adds prestige to our New Zealand records in a manner that is much appreciated by all true lovers of good purebred dairy stock. Since Aster's August Child is, on the sire's side, closely related to Sultan's Daisy, the new record may be taken as to some extent substantiating that of the present

Jersey champion, and will doubtless add popularity to this particular strain of Jersey breeding.

The senior two-year-olds have produced a new class-leader in Lady Superior, owned and tested by Mr. John Hale, New Plymouth. Her record of 680·33 lb. butterfat supersedes that of Lady Peggy, owned by Mr. E. Griffiths, New Plymouth, which cow has a credit of 650 lb. The new leader is by Soumise Tom, who is a son of Soumise Majesty, and from a daughter of Dalesman. The dam of Lady Superior is Princess Maid, a granddaughter of Campanile's Sultan. Princess Maid also traces to such well-known progenitors as New Zealand's Exile, Waikato's Fancy, Monopoly II, and Silver King (Stuckey's).

ASTER'S AUGUST CHILD.

The class for three-year-olds has two records reaching the 500-lb.-butterfat class in those of Oakland's Lassie, owned and tested by Mr. W. Anderson, Aokautere, Palmerston North, and Tiny Sylvia's Rona, owned and tested by Mr. A. E. Washer, New Plymouth. Oakland's Lassie is by Rab the Ranter, a grandson of Wild Cherry and Magnet's Lad. Her dam, Dossie, is a daughter of Señor, who is by Silver Conqueror from Senorita, a daughter of K.C.B. Senorita has two C.O.R. records, neither of which were for full time and therefore do not do her justice. Her daughter, Signorina, has a record reported in the four-year-old class of 560·11 lb. butterfat. She is owned and tested by Mr. R. F. Wilkinson, Pukekohe. Tiny Sylvia's Rona, by Sir Cuthbert from Tiny Sylvia, is an indication that a cow does not invariably require to have C.O.R. dams and granddams to enable her

to make a good record. There are doubtless many purebred cows in New Zealand that could make good records were they tested under good conditions, and thus a larger number of heavy-producing strains would be brought into prominence.

Of the eight records in the four-year-old class no less than five have credits exceeding 500 lb. butterfat, and one of these exceeds 600 lb. Fox's Lady, with a C.O.R. for 605·65 lb. butterfat, heads this list. She is a daughter of the imported Majesty's Fox, and on the dam's side is descended from such sires as K.C.B., King Thistle, and Tommy Atkins. She was tested by Mr. W. A. Guy, Matapu, and on such good grass country it was to be expected that the factors for production inherited by this cow would have an opportunity of displaying their

LADY SUPERIOR.

worth. That they have done so is evidenced by the production of Fox's Lady. Spec's Lady carries some of the same Jersey strains as Fox's Lady, she being a granddaughter of Majesty's Fox and tracing twice to K.C.B. She is owned and was tested by Mr. A. J. Harris, of Bombay, Auckland District. Other good records in this class are those of Te Mara's Zena Dare, who produced 567·79 lb. butterfat for Mr. C. A. Care, of Cambridge; Signorina, to whom reference has been made above; and Flossie Deem, who produced 548·04 lb. butterfat for Mr. T. Pollock, of Pukekohe.

The mature Jerseys in the list have many creditable records, the most outstanding being that of Dominion Lovely's Gem. This cow had been on test three times previously. She has now exceeded her best previous record by 117·66 lb. butterfat, her record commencing at the age of

9 years 249 days. She is by Yankee Sweet and from a daughter of Magnet's Lad out of a daughter of Musket. Dominion Lovely's Gem is owned and was tested by T. Pollock, of Pukekohe. Twylish's Dewdrop, owned and tested by Mr. W. Anderson, Aokautere, near Palmerston North, also reached the 500-lb.-butterfat class by a good margin. She is a daughter of Brighton Twylish from a daughter of Silver King out of a daughter of K.C.B. This daughter of K.C.B. was Queen of Flowers, a daughter of Sunflower III, who was by Dry Monopole. That Twylish's Dewdrop inherited producing factors to a very satisfactory degree cannot be doubted.

JERSEY RECORDS FROM 1ST JULY TO 30TH SEPTEMBER, 1920.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Aster's August Child	J. Nicolson, Kaupokonui	1 337	240·5	365	11,498·5	689·05
Rita's Lass ..	A. H. Huggett, Stratford	1 330	240·5	342	8,576·9	473·52
Bachelor's Flower ..	W. Luxton, Waitoa ..	2 40	244·5	365	7,751·5	450·17
Willow Bank Wonder	F. Ranford, Stratford	2 0	240·5	350	7,865·2	408·84
Laurel's Famous ..	F. Cresswell Palmerston North	2 28	243·3	365	6,859·0	403·86
Rozel's Breeze ..	J. B. Clemow, Stratford	1 276	240·5	365	7,532·7	403·01
Gold Bell	C. A. Care, Cambridge	1 314	240·5	365	7,988·3	402·46
Orielton Heather Bell	B. Tripp, Timaru ..	2 54	245·9	300	6,581·5	367·97
Oakvale's White Patch	C. H. Weston, New Plymouth	1 350	240·5	365	7,341·1	366·76
Willow Bank Ability	F. Ranford, Stratford	2 19	242·4	317	6,867·8	366·06
Cicero's Princess ..	H. H. Buxton, Hawera	2 22	242·7	364	6,566·2	364·43
Laurel's Heroine ..	F. Cresswell, Palmerston North	1 325	240·5	317	6,644·6	363·70
Bilberry's Darling ..	K. Rothe, Riverlea ..	1 318	240·5	319	5,581·5	351·73
Belle Clare ..	K. Rothe, Riverlea ..	2 4	240·9	324	6,055·6	327·62
Pretty Primrose ..	A. Buchanan, Palmerston North	2 23	242·8	307	6,144·3	326·09
Dainty Hawk ..	T. Pollock, Pukekohe	2 52	245·7	349	6,990·6	321·04
Vixen of O.K. ..	G. T. Gibbons, Ngaire	1 351	240·5	341	5,681·7	312·51
Oakvale's Doris ..	W. Mortlock, Normanby	1 306	240·5	365	5,126·4	312·16
Belvedere Pandora ..	James Shaw, Paterangi	2 36	244·1	241	5,141·3	283·33
Zeal of Bull's ..	F. J. Watson, Bull's..	2 5	241·0	347	3,987·4	267·90
Laurel's Dove ..	F. Cresswell, Palmerston North	1 357	240·5	298	4,888·3	254·35
Senior Two-year-old.						
Lady Superior ..	J. Hale, New Plymouth	2 183	258·8	365	9,975·5	680·33
Molina's Ripe Cream	H. T. Mellow, Stratford	2 276	268·1	298	9,545·5	496·74
Collingwood's Sweet Pea	W. R. Hayne, Timaru	2 119	252·4	365	8,515·3	485·63
St. Lambert's Bell ..	A. J. Smith, Cardiff ..	2 250	265·5	365	8,228·3	470·34
Laurel's Daisy's Sultana	F. Cresswell, Palmerston North	2 335	274·0	365	7,431·8	448·58
Brookland's Claribelle	R. P. Staples, Hamilton	2 334	273·9	365	7,718·0	406·41
Princess Ethel ..	W. G. Reece, Opotiki	2 296	270·1	309	6,815·5	356·02
Charm's Favourite ..	G. Buchanan, Paeroa	2 197	260·2	365	6,281·6	344·37
Roslyn Lady Flower	J. Harris, Bombay ..	2 241	264·6	359	7,177·9	334·18
Pencarrow's Triangle Queen	Mrs. C. Day, Tamahere	2 244	264·9	285	4,664·7	311·69

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Oakland's Lassie ..	W. Anderson, Aokautere	3 32	280·2	362	10,557·8	580·66
Tiny Sylvia's Rona	A. E. Washer, New Plymouth	3 168	293·8	365	9,117·5	564·76
Oakvale's Gin Gin ..	W. Mortlock, Normanby	3 11	278·1	365	9,315·5	484·23
Flora Deem ..	T. Pollock, Pukekohe	3 297	306·7	365	9,741·3	474·67
Zola	A. and J. O'Donnell, Inaha	3 341	311·1	344	9,372·8	472·26
Lady of Collingwood's Hope	Hellyer Estate, Dunedin	3 133	290·3	346	7,531·2	425·30
Saucy Queen ..	H. H. Phillips, Te Rehunga	3 225	299·5	365	8,778·8	416·97
Sunny Brae ..	T. Pollock, Pukekohe	3 150	292·0	333	6,896·6	368·29
Barbury's Princess ..	A. Hazelton, Waihou	3 47	281·7	283	6,719·9	359·51
Four-year-old.						
Fox's Lady ..	W. A. Guy, Matapu ..	4 332	346·7	325	11,192·7	605·65
Spec's Lady ..	A. J. Harris, Bombay	4 4	313·9	365	10,351·1	592·59
Te Mara's Zena Dare	C. A. Care, Cambridge	4 241	337·6	365	11,324·8	567·79
Signorina	R. F. Wilkinson, Pukekohe	4 331	348·6	365	10,477·3	560·11
Flossie Deem ..	T. Pollock, jun., Pukekohe	4 334	346·9	365	11,628·2	548·04
Maid's Pet ..	J. B. Clemow, Stratford	4 235	337·0	354	7,310·1	439·10
Pea Blossom ..	D. P. F. Malone, Kaponga	4 7	314·2	280	7,028·6	415·47
Laurel's Gipsy Queen	F. Cresswell, Palmerston North	4 7	314·2	320	7,320·4	373·16
Mature.						
Dominion Lovely's Gem	T. Pollock, Pukekohe	9 249	350·0	362	9,599·5	557·26
Twylish's Dewdrop ..	W. Anderson, Aokautere	7 265	350·0	365	11,163·8	531·16
Waitoa	J. A. McCallum, Inaha	7 253	350·0	365	7,922·5	492·04
Oakleigh's Chase ..	W. Luxton, Waitoa ..	5 91	350·0	338	7,524·4	478·86
Genoa Chase ..	W. J. Hall, Matatoki ..	7 7	350·0	338	7,935·5	472·29
Floria's Gem ..	J. F. Vosper, Matamata	6 8	350·0	329	6,976·7	459·62
Mystery's Pamela ..	J. F. Vosper, Matamata	5 65	350·0	331	8,308·4	456·28
Goldlace	J. R. Jones, Tariki ..	5 31	350·0	338	7,504·0	452·71
Floria's Pleasure ..	J. F. Vosper, Matamata	5 299	350·0	292	8,406·9	449·96
Belle of Puketapu ..	H. R. Benbow, Ormondville	6 330	350·0	219	7,285·6	443·03
Golden Gleam ..	S. Atkinson Papatoetoe	5 240	350·0	355	7,602·6	439·78
Merry Queen ..	J. B. Clemow, Stratford	5 105	350·0	315	7,009·9	414·19
Briar Lady ..	H. H. Buxton, Hawera	5 336	350·0	287	7,155·3	358·49
Oakden Gazelle ..	E. Harding, Woodville	5 338	350·0	300	6,026·2	351·95

Lucerne and Butterfat Records.—Mr. J. W. Deem, Fields Instructor, writes, "It is interesting to note that the new C.O.R. class-leader in the Jersey two-year-olds, Mr. James Nicolson's Aster's August Child, was grazed on lucerne throughout her milking-period."

STRATFORD MODEL DAIRY FARM.

NOTES ON OPERATIONS.

J. W. DEEM, Fields Instructor and Supervisor of Subsidized Demonstration Farms.

DURING the year 1919–20 the negotiations for the purchase of the freehold of the farm were completed. The obtaining of a permanent title is a matter on which the society is to be congratulated, and future progress and improvements can now be entered upon without any fear that the property may pass into other hands. The money necessary to pay for the freehold was secured by the guarantors agreeing to an increased bank overdraft.

Improvements have been continued as fast as funds would permit, and in the three years the society has been in occupation of the farm approximately 60 acres have been stumped.

After writing off the usual amount for depreciation the sum of £283 12s. was carried to the General Fund Account, which now stands at £833 7s. The butterfat-production for the year shows an increase of 12½ per cent.

EXPERIMENTAL WORK.

This was much on the same lines as last year, but was extended to include the testing of a number of varieties of cabbage and the making of ensilage.

The spring was rather late and cold, with a rainfall below normal, while the six months January to June were very wet with abnormal rainfall. Although crops were late in starting, the moist autumn helped them along, and they were on the whole good.

As the farm has now been in operation for three years some of the average results over that period will be of interest.

Soft Turnips.

A great many varieties have been tested, but over the three years the following six have given the best average results: Early American Purple-top, 51 tons 16 cwt.; Lincolnshire Red Globe, 50 tons; Imperial Green Globe, 46 tons 6 cwt.; Purple-top Mammoth, 47 tons 7 cwt.; Red Paragon, 45 tons 12 cwt.; Hardy Green Globe, 41 tons 9 cwt. Romney Marsh and Greystone have also given good averages. The manure used throughout the period has been basic super, at the rate of 3 cwt. per acre.

Swedes.

Thirty-two varieties were tested this last year for weight and resistance to dry-rot. When weighed at the end of May these gave percentages of rot ranging from 1 to 30 per cent. They were again examined in August, when many of the varieties showed almost the whole crop affected. The least affected varieties were Vilmorin's Early Purple-top, Garton's Master and Acme, and Sutton's and Hurst's Magnum Bonum. The first-named is a white-fleshed swede, and in addition to being fairly free from rot it is greatly relished by stock, being preferred to all other varieties. It will be tested this year on a much larger scale.

The three swedes giving the best average weights on the farm for the past three years are Superlative (44 tons 14 cwt.), Best of All (40 tons 10 cwt.), and Magnum Bonum (37 tons 10 cwt.). Although Superlative has given the heaviest weight it is one of the worst for dry-rot, and where this disease is prevalent farmers would be well advised to sow a portion of their swede crop with a better keeper.

A number of manurial tests with swedes have been carried out during the past three years, and taking the standard manures used at the rate of 3 cwt. per acre, the average yields for the period have been as follows: Basic super, 38 tons 12 cwt.; bone, slag, and super, equal parts, 38 tons 10 cwt.; basic slag, 35 tons 3 cwt. Over a period of two years bone, slag, and super, equal parts, has given yields of 39 tons 10 cwt.; Ephos basic phosphate, 37 tons; Fabre Island guano, 35 tons 18 cwt.; and Surprise Island guano, 33 tons. Nitrogenous manures added to any of these phosphatic manures have not increased the crops; in fact, in most cases a decrease has been recorded.

The advantage of liberal manuring is strongly demonstrated by the fact that the average crop grown with 3 cwt. of basic super per acre is 38 tons 12 cwt., against the average for the no-manure area of 13 tons 10 cwt., or 25 tons 2 cwt. in favour of the manure.

Mangolds.

The testing of various varieties has been continued, and the following have given the best average over the three years: Prizewinner, 49 tons; Long Red, 45 tons 1 cwt.; White Sugar, 42 tons 14 cwt.; Jersey Queen, 39 tons 14 cwt. In the test to determine the value of salt, at the rate of 3 cwt. per acre, the average increase per year for the three years has been 9 tons 4 cwt. per acre in favour of the salt.

Carrots, Kales, and Cabbages.

Matchless White, White Belgian, and Magnum Bonum carrots have given the best results.

Several varieties of kale have been tested, but Buda kale grown from New-Zealand-saved seed continues to give the best results.

Twelve varieties of cabbage were tested for field purposes last season. The three best were: Sutton's Giant Drumhead, 33 tons 6 cwt. per acre; Robinson's Giant Ox, 32 tons 8 cwt.; and Cooper's Giant Drumhead, 32 tons 8 cwt. These were sown at the end of November; the cabbages were ready for feeding in April, and kept in good condition until June.

Cereals and Tares.

These were grown as special ensilage crops. When in combination at the seeding-rate of 2 bushels of the cereal to 1 of the tares or peas there was not much difference in the gross weight of the fodder. This ratio appears to give the best results in the Stratford district, averaging between 11 and 12 tons of green material per acre. Details of these crops and the making of ensilage were given in the September *Journal*.

Pasture Top-dressing.

Field 2: In this field, which was top-dressed in 1917 (see last year's report in October, 1919, *Journal*), horses have continued to show a decided liking for the slagged area. Portions of this field were closed

up last spring, and the hay cut and weighed. The basic-slag area gave 4·12 tons of green material per acre, and the Ephos phosphate area 3·82 tons.

Field 5: The cattle have continued to eat this evenly. A portion of the field was closed for hay, and gave the following weighings of green material per acre: Area 1, top-dressed with basic super, 3 cwt. per acre, 5·83 tons; area 2, top-dressed with basic slag, 4 cwt. per acre, 6·09 tons; area 3, top-dressed with Ephos phosphate, 4 cwt. per acre, 6·04 tons. All these top-dressings had been applied in August, 1917. The field was examined before the hay was cut, when no difference could be noticed on the different areas, and the weights of green material confirm this.

Field 12, bush paddock: Eight areas in this field were treated with phosphate manures in August, 1919, at the rate of 4 cwt. per acre, as follows: Plot 1, rock phosphate; plot 2, basic slag; plot 3, Ephos phosphate; plot 4, 2 parts Surprise Island phosphate, 1 part super; plot 5, Surprise Island phosphate; plot 6, control (no treatment); plot 7, 1 part carbonate of lime, 1 part rock phosphate; plot 8, 1 part burnt lime, 1 part super; plot 9, basic super. In August, 1920, plots 8 and 9 were the best, with plot 2 close up. Then came plots 3 and 4, while plots 1, 5, and 7 show little, if any, improvement over the control plot. A further reference will be made to these areas next season.

LICE ON SHEEP: A WARNING.

It is to be regretted that the infestation of sheep with lice is on the increase in many parts of the Dominion. No doubt this is due to the past war conditions, when farmers were seriously handicapped for want of labour. The co-operation of farmers is earnestly solicited in an effort to materially reduce this pest, if not to eradicate it altogether. Instructions have been given that the relevant provisions of the Stock Act are to be stringently enforced in the future, and that prosecutions will follow in every case where sheep infested by lice are exposed for sale. Close watch will be kept as far as possible by Stock Inspectors upon saleyards for this purpose. It is trusted that stockowners and dealers will take this timely warning, and also as regards the enforcement of that portion of the Act making compulsory the dipping of all longwool and crossbred sheep, whether for sale or not. There is another species of lice besides that which inhabits the body of the sheep; the former infest principally the legs and bare parts of the body. The Act applies equally to them, and the treatment for their destruction is just the same as for body-lice.

It may be here stated that, judging by the evidence of defendants in prosecution cases, it is quite evident sufficient care is commonly not taken regarding the strength of the dips used. Oxidation, dilution, and other changes take place, and, except in the case of a freshly made-up dip wholly of new material, care should be taken to test the strength of any existing solution before adding more. An ineffective dip is worse than useless, as it misleads the owner and is no sound defence if action is taken by the Department.

—A. R. Young, M.R.C.V.S., Director of the Live-stock Division.

TESTS IN WINTER FEEDING OF LAMBS.

T. W. LONSDALE, Manager of the Moumahaki Experimental Farm.

THE principal auxiliary crops now used for the wintering of lambs are turnips and swedes, but while these roots are probably most suitable there is not a sufficient area devoted to them to supply present requirements. With a view of gathering data regarding other suitable methods of feeding a short preliminary test was recently carried out at the Moumahaki Experimental Farm. In May last a line of white-face lambs which had not previously received artificial food was divided into four lots of twenty each, these being weighed and marked with a distinguishing brand.

Lot 1 was turned out on swedes with the main flock of lambs, and received in addition to swedes as much chaffed pea-straw as the animals could consume. This straw was fed from self-feeding bins placed in an adjoining pasture, which, however, would only be termed a run off.

Lot 2 was placed on pasture and given lucerne hay *ad lib.*

Lot 3 was put on pasture with other sheep.

Lot 4 was placed on pasture and fed ordinary hay.

Only one lamb died (this being in lot 4), but as the death occurred two days after the test commenced it could not be taken into consideration, and, in any case, it was not attributable to the respective environment.

The lambs having been sold, the test terminated on 24th July. The average weights per head at the commencement and end of the trial, together with the respective gains for each lot, were as follows :—

Lot 1 : Weight per head—25th May, 64 lb. ; 24th July, 75·6 lb. Gain per head, 11·5 lb.

Lot 2 : Weight per head—25th May, 63·2 lb. ; 24th July, 74·3 lb. Gain per head, 11·1 lb.

Lot 3 : Weight per head—25th May, 54·2 lb. ; 24th July, 64·4 lb. Gain per head, 10·2 lb.

Lot 4 : Weight per head—25th May, 62·3 lb. ; 24th July, 73 lb. Gain per head, 10·7 lb.

It will be seen that while all the lambs made ordinary winter growth there was very little difference between any of the lots. Although lot 3 was running on old pasture without any additional food, these lambs were thinly distributed as compared with the other lots. The results of this trial must not be taken as conclusive, but they point to the fact that with judicious treatment the death-rate of young sheep during their first winter can be considerably minimized. It is proposed to extend similar tests next winter season, carrying the sheep over to shearing.

The Kea Pest.—The subsidy payable by the Department of Agriculture to local bodies for the beaks of keas has been increased to 5s. each, as from 1st October.

GORE EXPERIMENTAL AREA.

OPERATIONS IN SEASON 1919–20.

W. ALEXANDER, Fields Instructor, Invercargill.

SECTION 1. TEMPORARY PASTURE (PURE PLOTS).

THIS section contains an area of approximately 3⅓ acres, and is divided into three equal plots. It was ploughed out of linseed stubble in August, 1919; limed with carbonate of lime (90·41 per cent.), 2 tons per acre, in October; and sown down in mid-November as follows, the whole section receiving superphosphate at the rate of 1½ cwt. per acre: Plot 1—perennial rye-grass (germination 80 per cent.), 2 bushels seed; plot 2—Italian rye-grass (germination 89 per cent.), 2 bushels; plot 3—Western Wolths rye-grass (germination 72 per cent.), 2½ bushels.

Each plot was fenced off independently and grazed with sheep. Weaner lambs were put on on 31st January, at which date the plots were reported on briefly as follows: Western Wolths was showing vigorous growth and already forming seed-heads. Italian rye had made a growth of about 8 in. and was looking well, but a fair amount of sorrel was showing. Perennial rye was the most backward of the three; the growth made was from 5 in. to 6 in., and sorrel was easily predominating.

The system of stocking provided for ten lambs on plot 1, ten on plot 2, and twenty on plot 3. Plot 1 carried its quota from 31st January until 11th February, on which date the plot was carefully examined, and as a result the number of lambs was doubled, twenty being put on from 11th to 19th February. The lambs had not made much impression on the grass, but the grass had made a good impression on the lambs, as they had improved greatly. The twenty lambs could have been carried safely another week, but it was considered advisable not to overdo it for a start. A fair amount of sorrel was still showing.

Plot 2 carried ten lambs from 31st January until 11th February, on which date the number was doubled, twenty being grazed there from 11th to 19th February. Even the double stocking had failed to make much impression and the grass was running to seed, so ninety-four lambs were crowded on to this acre of Italian for two days. This had the effect of clearing off a good deal of rough feed, but it was still necessary to run the mower over the area to cut down the rough growth left. The sorrel had practically all disappeared.

Plot 3 carried twenty lambs over the first period of twelve days, then the number was doubled, when it carried forty lambs for seven days. The grass was getting completely away in spite of this heavy stocking, and the lambs had improved rapidly. For two days ninety four lambs were crowded on to this plot, but they failed to clean it up, so the mower was used here also.

Two factors here stand out as worthy of notice in connection with Western Wolths rye-grass—(1) its early maturity, (2) its fattening-

qualities. To illustrate the first point, the seed was sown on 17th November, and it was stocked on 31st January, and would have been better had it been stocked a week earlier. As regards the second point, at the end of seventeen days' grazing the buyer went through and selected 55 per cent. of these lambs as prime, although when put on the Western Wolths they were ordinary weaners just off the hills.

SECTION 2. SOFT TURNIPS.

This section (about 3 acres) was devoted to a soft-turnip variety trial, the object being to test six well-known varieties against each other under three distinct factors—yield, keeping-quality, and palatability.

The land was ploughed to a depth of 8 in. in September, then limed with 2 tons per acre of carbonate of lime (90·41 per cent.) in October. The seed was sown on 15th December, and the manures used were the same all over the section—namely, superphosphate 2 cwt., plus carbonate of lime 2 cwt., per acre.

The varieties were as follows: Plot 1, Garton's Hardy Green Globe; plot 2, Garton's Mammoth Purple-top; plot 3, Garton's Lincoln Red Globe; plot 4, Garton's Purple-top Scotch; plot 5, Garton's Green-top Scotch; plot 6, Garton's Deep Golden Yellow Long-keeping.

Yield: The weighings were carried out on 9th June, with the following results per acre (roots and tops combined): Plot 1, 31·29 tons; plot 2, 32·11 tons; plot 3, 33·93 tons; plot 4, 22·84 tons; plot 5, 20·83 tons; plot 6, 19·03 tons.

Palatability: So far as this test has demonstrated palatability, from observations made on the ground I should place the several varieties in the following order of preference: (1) Deep Golden Yellow Long-keeping; (2) Hardy Green Globe; (3) Green-top Scotch; (4) Purple-top Scotch; (5) Lincoln Red Globe; (6) Mammoth Purple-top.

Keeping-qualities: These were tested by reserving a narrow strip, 6 ft. wide, off the end of each plot. This reserved area was examined carefully on 18th August, and the following recorded:—

Hardy Green Globe: Badly affected with dry-rot at a late stage in their growth. The bulbs were not seriously damaged, as the infection had not gone further than the characteristic brown surface spots. Several bulbs were running to seed, and the bulbs generally becoming pithy; they must have lost considerably from the nutritive point of view.

Mammoth Purple-top: Considerably affected with dry-rot, but it had not gone deeper than surface spots. A number of bulbs had gone badly with soft rotting. The crop was going to seed badly, and the bulbs were quite pithy. This plot was really past being of any value.

Lincoln Red Globe: The whole plot had gone away to seed, and the bulbs were quite hollow. Dry-rot spots were also very numerous.

Purple-top Scotch: This plot continued to look well and was quite free from dry-rot. A few bulbs were beginning to show signs of soft rotting, but the majority were still sound and crisp.

Green-top Scotch: The crop was still quite sound-looking and apparently free from disease. Several bulbs, however, were developing pithy centres, indicating that they would not stand much longer.

Deep Golden Yellow Long-keeping: Fairly sound condition and free from disease. Bulbs, when cut, showed a tendency to become pithy, but might be considered to be still fair feed.

A comparison of representative bulbs from each of the six plots placed them in order of keeping-quality thus: Purple-top Scotch, Deep Golden Yellow Long-keeping, Green-top Scotch, Hardy Green Globe, Mammoth Purple-top, Lincoln Red Globe.

The value of the entire crop in this section may be summed up by reference to the amount of grazing the roots actually stood, based on the following particulars: 600 hoggets were put on on 11th June and were taken off on 14th June. Two hundred and eighty wethers were put on on 14th June (having replaced the hoggets) and kept there until 20th June, when the number was reduced to 130, and this latter number was left until 2nd July. Working on this basis, and calculating the period for which turnips would normally be required at eighteen weeks, it is found the crop would carry fifteen sheep per acre for the season.

SECTION 3. SWEDE DRY-ROT INVESTIGATION.

This special investigation is being dealt with separately.

SECTION 4. OAT VARIETY TRIALS FOR YIELD.

This section, approximately 3¼ acres, was ploughed to a depth of 8 in. in September, and then prepared for oats. The previous year's crop had been soft turnips, which were grazed off. Owing to a particularly late season, sowing of oats was not carried out until 25th October. The section was measured off into three equal plots and sown, together with basic super at 3 cwt. per acre in each case, as follows:—

Plot 1, Black Tartars, 3½ bushels seed; plot 2, Gartons, 4 bushels; plot 3, Duns, 3½ bushels.

Each of the three plots came away well, and continued to do well until harvested for chaff in February. The crops were stacked separately and remained in stack until 1st July, when they were cut into chaff, with the following yields: Plot 1, Black Tartars, 4 tons; plot 2, Gartons, 3 tons 15 cwt.; plot 3, Duns, 3 tons 16 cwt.; or a total of 11 tons 11 cwt. from the area of 3¼ acres.

SECTION 5. MANGOLDS, POTATOES, AND SWEDES.

Mangolds: The mangold varieties were sown at the request of some members of the Gore Agricultural Committee, who apparently were anxious to see this crop tried out. The results have been somewhat disappointing, and are certainly not a recommendation for mangolds in the South. The germination was good, but the subsequent growth was very poor—so much so that no weights were actually taken. Further trials may be conducted in 1920–21, based on the experience of the past season.

Swedes: This consisted simply of a trial of Garton's Master variety. A plot sown on 28th November with 3 cwt. super, plus 1 cwt. carbonate of lime, produced a yield at the rate of 30 tons 11 cwt. per acre.

Potatoes (main crop): Three varieties—Sutton's Supreme, Up-to-Date, and Northern Star—were grown, the manurial treatment being the same in each case—namely, super 3 cwt., wood-ashes 2 cwt., and

sulphate of ammonia 1½ cwt. per acre. Unfortunately, accurate weights could not be taken, our scales being out of commission at the time, but the yields, in sacks, worked out as follows, and afford some comparative data when taken in conjunction with the area in rows as shown :—

Variety.	Number of Rows.	Table.	Seed.	Small.	Total.
Sutton's Supreme ..	25	9	6	4	19
Up-to-Date	26	18	8	6	32
Northern Star	29	22	8	8	38

SECTION 6. PERMANENT PASTURE (IN PLOTS).

This section was well cultivated prior to being sown in permanent plots in November. The land was limed with carbonate of lime (90·41 per cent.) at the rate of 2 tons per acre.

The plots are as follows : Plot 1, cocksfoot (germination 84 per cent.), 20 lb. per acre ; plot 2, timothy (germination 96 per cent.), 15 lb. per acre ; plot 3, prairie-grass, 56 lb. per acre ; plot 4, crested dogstail (germination 95 per cent.), 15 lb. per acre.

The manurial treatment was the same all over—namely, 1½ cwt. superphosphate per acre, broadcasted by means of the manure drill. The growth has been good, and the grass has been kept down by mowing or sheep-grazing.

SECTION 7. PERMANENT PASTURE SOWN DOWN IN 1918–19 SEASON.

The grass-mixture used in this section of 4 acres is as follows : Italian rye-grass, 6 lb. ; perennial rye-grass, 10 lb. ; cocksfoot, 8 lb. ; timothy, 4 lb. ; meadow-fescue, 5 lb. ; meadow-foxtail, 3 lb. ; crested dogstail, 2 lb. ; Poa trivialis, 2 lb. ; alsike, 2 lb. ; cow-grass, 2 lb. ; white clover, 2 lb. : total, 46 lb. per acre.

The area was cut for hay on 9th January, 8 tons being secured. Subsequent to the hay crop the 4 acres carried 100 lambs for fourteen days—27th February to 11th March, inclusive.

SECTION 8. ORIGIN OF SEED-OAT TRIALS FOR YIELD.

The object of this test was to try out, under similar conditions, several varieties of oats drawn from various localities to ascertain the influence of locality on yield. Each of the eight plots was sown on 27th October with 2 cwt. super per acre, the seeding being at the rate of 3½ bushels per acre. The details are as follows :—

Plot.	Variety.	Locality grown.	Yield per Acre (Firsts only).
1 ..	Guyra	Australian	35
2 ..	Lachlan	Australian	37
3 ..	Duns	Springburn	60·7
4 ..	Gartons	Ashburton	85
5 ..	Duns	Kelso	62
6 ..	Gartons	Lumsden	75
7 ..	Gartons	Balfour	55
8 ..	Duns	Crown Terrace ..	43·2

The test did not really give either of the Australian varieties a good chance, as these plots ripened very early and fed all the small birds in the vicinity. It may be taken as certain that 20 per cent. of the grain was eaten out by the birds. In all cases the sample of grain threshed was very good, and the trial generally afforded quite an interesting test of the effect of locality.

ANALYSES OF SUGAR-BEETS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE following table gives particulars of the analyses, in the Chemical Laboratory, of sugar-beets grown last season at several of the experimental farms and areas. The variety in each case was Klein's Wanzleban.

Laboratory No.	Locality.	Average Weight of Roots.	Dry Matter.	Sugar.	Purity Coefficient.	Mean Percentage of Sugar.
		lb. oz.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
M/237	Waimate West ..	4 8		12·84		
		3 6	20·70	13·16	87·6	13·46
		2 6		13·70		
		1 5		13·80		
M/238	Stratford ..	4 12		13·44		
		3 8	21·20	13·60	88·3	13·50
		2 5		13·56		
		1 7		13·20		
M/239	Marton	4 10		14·12		
		3 6	20·90	14·86	88·6	15·32
		2 6		15·10		
		1 10		15·26		
M/472	Ashburton ..	5 6		14·62		
		4 3	21·50	15·86	89·2	15·98
		3 6		16·20		
		2 9		15·74		
M/473	Weraroa.. ..	5 4		14·04		
		4 10	21·30	14·30	89·0	14·74
		3 9		15·06		
		2 5		14·82		

NOTES ON THE CROPS.

M/237: Sown 25/10/19; weighed 1/6/20. The plot was manured with superphosphate, bone, and Ephos phosphate, equal parts, at the rate of 4 cwt. per acre. Yield per acre, 26 tons 7 cwt. 16 lb.

M/238: Sown 12/11/19; weighed 2/6/20. Manure used, basic super at 4 cwt. per acre. Yield per acre, 16 tons 14 cwt. 32 lb.

Both of the above crops made heavy top-growth; but in both cases the roots were very uneven in size and of only fair quality.

M/239: First sown 17/10/19, with 6 cwt. per acre of mangold-manure; but as the germination was bad and the plants that did come

were smothered with spurrey the ground was again worked up, and a second sowing made on 24/11/19, with 2 cwt per acre of basic super. This crop was again hampered with spurrey, and only a small area was saved. The roots were uneven in size and shape, and there was a heavy top-growth. Weighed 10/6/20; yield per acre, 22 tons 10 cwt.

M/472: Sown 16/10/19, with superphosphate at 1½ cwt. per acre. The beets were lifted in June, and yielded 18·75 tons per acre.

M/473: Sown in November, 1919, on heavy loam, following on a pea crop. The manure used was 5 cwt. salt, ¾ cwt. sulphate of ammonia, 3 cwt. superphosphate, and wood-ashes equivalent to 1 cwt of potash (1 ton), per acre. The crop was harvested in June, 1920, and yielded 24 tons 10 cwt. per acre.

In the case of both M/472 and M/473 the roots were mostly large and well formed.

Illustration of Hemlock.—By the omission of a word in the title-matter of the drawing of hemlock published in last month's *Journal* (p. 117) figures A to D were described as natural size instead of *half* natural size.

Weraroa Sale of Pedigree Cattle.—The sale of pedigree cattle at the Central Development Farm on 7th October attracted a large number of buyers, and bidding was brisk. The Friesian bulls (five lots) averaged £48 18s. 7d., the highest price paid being for Dominion Woodcrest of Weraroa, at 72 guineas; the Friesian females (thirty-three lots) made an average of £62 9s. 2d., top price being for Dominion Sadie Vale, with 105 guineas. The Red Poll bulls (three lots) averaged £59 17s., the highest figure being secured for Dominion Mount Holdsworth, at 101 guineas. The sale receipts totalled £2,485 7s.

Dry-rot Fungus of Swedes.—Mr. A. H. Cockayne, Biologist, who visited the United States last year, makes the following remarks on this subject in his annual report for 1919–20: Much valuable information on the control of cabbage *Phoma* was secured in Wisconsin, where infected seed has been shown to be the main method of spread. From experiments conducted here, however, it appears conclusive that the swede dry-rot fungus (*Phoma napo-brassicae* Rost.) is a soil saprophyte capable of living in the ground for several years. Nevertheless its appearance from time to time in crops grown on virgin land indicates that the sowing of infected seed is a factor in its dissemination. From the preliminary experimental work carried out it has been shown that the application of large quantities of water-soluble phosphates increases the disease considerably, and that potash manures have a depressing effect on the development of the fungus. Much work of a fundamental nature remains to be done before practical methods of control can be laid down.

WORK FOR THE COMING MONTH.

THE ORCHARD.

ALTHOUGH the final details relative to last season's export shipments have not been completed, a general settlement has practically been made based on prices which cannot be considered otherwise than highly satisfactory. In consequence of this the coming season's transactions are likely to be taken with a considerable amount of increased confidence, resulting, no doubt, in a very much increased supply of fruit being available for export.

Up to the present the shipping authorities have been asked to reserve the refrigerated space equivalent to a hundred thousand cases, but it is quite possible that a further fifty thousand will be asked for. In the meantime, until the pencilling-in of space—which I understand is being actively pushed on, in the Nelson District at least—has been completed it is impossible to anything like accurately estimate the amount of space required.

Further, in connection with the coming season's export, it is of interest to note the progress that is being made in the Nelson District, which district for many reasons is destined to play a leading part in any export trade which may build up in the future. The growers of Nelson have formed what is known as the Nelson Provincial Fruitgrowers' Council. This organization, which is designed to work in co-operation with the New Zealand Fruitgrowers' Federation, having been appointed "district agent" for that body, is, apart from organizing the growers of the district generally, devoting its efforts primarily toward the effective systematic control of export fruit from the Nelson District. Other movements are afoot among the growers of Nelson. Several new packing associations have sprung up, and are now actively endeavouring to establish packing-facilities in readiness for the handling of the coming season's crop. These and other activities in that district suggest that the growers of Nelson fully appreciate the effect that a successful export trade will have on the future of their industry, and it is to be hoped that their present endeavours will continue until that success is assured. —*J. A. Campbell, Assistant Director of the Horticulture Division.*

AUCKLAND.

Fire-blight: On account of the outbreak in the Waikato and the possibility of a further infection in or near the larger commercial areas, every orchardist is asked to use all means in his power to identify any occurrence of this disease in his particular locality. Any suspicious symptoms should be immediately reported to the Orchard Instructor in charge at the Auckland office, in order that steps may be taken to prevent a further spread. As it has now been definitely established that *Crataegus* plants (hawthorn, whitethorn, &c.) carry the disease over from one season to another in this country, this particular family may be looked upon as our chief source of infection. In several of the larger commercial areas in the Auckland District there is, happily, but a very small amount of hawthorn at present in existence, and as a preventive measure every orchardist is asked to destroy, by grubbing out and burning, any such hedges which may be on his property. By doing this he is protecting not only himself, but every other orchardist in the immediate vicinity. This disease is not at present by any means established in the commercial areas, and it is much more desirable to use preventive measures now, rather than wait and then have to apply the only cure—*i.e.*, destruction of infected plants and trees.

Spraying: The chief operations will be those for the control of eating-insects, and also for brown-rot of stone-fruits and black-spot of pip-fruits. The spraying programme for the month may be summarized as follows: Apple, pear, and quince—bordeaux, 3–4–40, when fruit set; bordeaux, 2–3–40, or commercial

lime-sulphur, 1–100 (33° Beaumé), three weeks later, in combination with arsenate-of-lead paste, 1½ lb., or powder, ¾ lb., to 50 gallons water. Peach, nectarine and plum—commercial lime-sulphur, 1–125, or self-boiled lime-sulphur, 8–8–50, one month after fruit-set. Citrus fruits—bordeaux, 4–4–40, when blossom-petals fall during the spring flowering, followed by red oil, 1–40, about fourteen days after.

Citrus-growers are advised where frosts have affected the growth, killing it back, to cut away all frosted parts to a bud. Failure to do this may bring on gummosis, and leave effective opportunities for the entry of borer.

Ploughing operations must now be completed, followed by the very necessary undertaking of working down the soil into a good tilth, before the dry weather sets in. With the ever-rising cost of labour the commercial orchardist will be on the lookout for every possible means of saving labour, and the procuration of all labour-saving implements. Wherever possible, ploughing up as close to the trunk of the tree without damaging the feeding-roots, by means of the bridle on the plough, should be undertaken.

Thinning is a most important operation, and as soon as it can be seen that the fruit is properly set this work should be carried out on apples and pears. With stone-fruits it is necessary to wait until after stoning.

The disbudding of young trees (two to three years old) must be attended to, rubbing out the buds low down on the trunk, and leaving only sufficient buds for the formation of the main arms of the tree.

Growers are reminded that the regulations controlling the sale of locally grown fruit and the branding of cases are now in force, and this should be borne in mind when ordering new cases.

—*J. W. Collard, Orchard Instructor, Auckland.*

HAWKE'S BAY.

Attention should be given to cultivation, working the surface soil to a fine tilth, thus retaining moisture and destroying weeds.

Young trees should be looked over and all superfluous growth removed; the best result is obtained by removing such when they can be pinched out. Undesirable growths should also be removed from older trees; these growths frequently occur where a large limb has been removed, and choke up the inner part of the tree if not cut out.

Should this season's setting of fruit be up to blossom-indication, thinning will have to be undertaken in most instances to ensure a good class of fruit.

Spraying for the month will be as follows:—Codlin-moth: Arsenate of lead, 1½ lb. paste or 1 lb. powder to 50 gallons water. Black-spot: Apples—lime-sulphur, 1 100; pears—lime—sulphur, 1–80; should black-spot show up, use bordeaux, 3 4–40. Powdery mildew: Lime-sulphur, 1–100, or atomic sulphur, 1 lb. to 10 gallons. Leach on plums: Arsenate of lead, 1 lb. paste or ¾ lb. powder to 50 gallons water. Red mite: Continue applications of lime-sulphur, 1–100, at eight-day intervals while mite is present. Lime-sulphur may be applied with arsenate of lead, but fresh lime, equal weight to arsenate, should be added to safeguard against spray damage.

—*W. H. Rice, Orchard Instructor, Hastings.*

NELSON.

The practice of spraying stone-fruit soon after setting with lime-sulphur, 1–120, plus the milk from 6 lb. of lime, for the prevention of brown-rot has given very encouraging results, and it is recommended for the present season. The same mixture (rather stronger, say, 1–100) should be applied to apples and pears as soon as they have set. To it should be added arsenate-of-lead paste, 3 lb., or half that quantity of powder. Where there is difficulty in controlling black-spot it is customary to make another application of bordeaux with arsenate of lead in place of the above.

Trees should be carefully watched at this period and prompt steps taken to deal with undesirable developments. Leaf-hopper, for instance, will probably be troublesome in some sections. Trees so infected should have Blackleaf 40, 1 pint, added to the 100 gallons of lime-sulphur mentioned above. These sprays applied at this period are spoken of as calyx-sprays, and should be repeated after an interval of about three weeks or a month.

Trees sometimes set a larger crop than they can mature or even carry. The capacity of a tree should not be strained; superfluous fruit must be thinned off without delay, taking care to remove all fruit from the tops of the leaders.

The weaker trees in the orchard require a good deal of attention of this kind; small dressings of nitrate given to such trees at this time will be of great assistance.

It will be now some two months since the spring ploughing, and vegetation turned in will have decayed. A second ploughing would be advantageous, across the last if possible. Follow this operation promptly with the harrows.

Young trees and those that have been regrafted will have now made numerous growths of a few inches in length. Stop those that are superfluous by pinching out the growing point; by this means the shape and economy of the tree is much enhanced.

The operation of grafting may still be performed if suitable scion wood can be obtained. —*W. C. Hyde, Orchard Instructor, Nelson.*

MOTUEKA.

The thinning of fruit may be undertaken about this stage. Remove malformed and diseased fruit when performing this operation; the results well repay the trouble taken where crops are heavy. The production of "cull" fruits should be avoided where possible, as they only increase the cost of handling, &c., and decrease net returns per case.

Cultivation should be attended to and the soil kept in good tilth for the coming hot weather.

Spraying measures will consist of the usual application of arsenate of lead, 1½ lb. paste or ¾ lb. powder to 50 gallons water, to be applied about every third week. This will serve to control codlin-moth on pip-fruit. The same spray applied to cherries and plums when pear-slug makes its appearance will have the effect of keeping this pernicious insect under control.

Lime-sulphur should be used at this stage for control of fungus diseases and red mite, at the following strengths: Pears, 1-80 to 1-100; apples, 1-100 to 1-120; stone-fruits, 1-125. —*W. T. Goodwin, Orchard Instructor, Motueka.*

CANTERBURY.

With the appearance of these notes summer work will have commenced in the orchard, and growers will be estimating their crops. The trees will be in full leaf, and consequently care must be exercised with the spraying, remembering that healthy foliage is necessary in order to obtain the best results. The chief trouble in this district will be black-spot, especially if the weather is at all favourable for the development of the spores. Lime-sulphur, 1-100 to 1-120, should prove effective in checking the spot on apples, and bordeaux, 3-4-40, on pears. The necessity for testing the different sprays, and the thorough cleansing of spray-pump and tank, have been dealt with previously. Powdery mildew may be noticed on the growing tips of the shoots, and, as recommended in last month's notes, should be cut out and burnt where possible, spraying the tree with lime-sulphur 1-100, or atomic sulphur, 8 lb. to 100 gallons water. Woolly aphis can be kept in check with Blackleaf 40, 1-1,000, using plenty of force to drive the spray well in to the colonies. Applications of arsenate of lead should be given for the control of codlin-moth, leaf-roller, pear-slug, &c.

Thinning is an important operation very much neglected. Where it has been done growers have noticed the difference with regard to size, quality, disease, and the health of the tree generally. All top fruit on young trees should be removed, giving the trees every chance to develop and form a good framework.

Disbudding work applies particularly to young trees planted this season, taking out all unnecessary growths, thus diverting the sap where required for the building-up of the tree.

Pay all attention to cultivation by constantly stirring the soil with the cultivator or harrows, thus retaining the moisture and suppressing the weeds.
—*G. Stratford, Orchard Instructor, Christchurch.*

OTAGO.

Now that the fruit is once more on the trees vigilance should be the watch-word. It has been truly said the grading of fruit should commence as soon as the fruit is set. By care and attention to cultivation, manuring, spraying, and thinning of fruit the maximum of success will be obtained. Aim to produce the best quality possible, especially in stone-fruits. It is quite probable the demand for poor-quality fruit for jam will not be great, owing to the high price and short supply of sugar. With indications of heavy crops it is desirable to thin carefully and procure good-quality fruit suitable for dessert purposes.

Follow up the spraying indicated in last month's notes, reducing the lime-sulphur spray to 1-120 as the weather gets hotter, or atomic sulphur at 8 lb. to 10 lb. to 100 gallons.

Pay attention to newly planted trees by removing surplus shoots, retaining those best situated to form well-shaped trees. Also give attention to regrafted trees, removing the shoots from the stocks to allow the scions every chance to start into good growth. Remove all fruit from the previous season's growth on young apple-trees, as the leading shoots become weak and misshapen if this is not done. —*J. H. Thorp, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

HATCHING AND REARING OF DUCKLINGS.

ALTHOUGH the correct season for hatching out chickens has now passed—that is to say, if they are to grow to a desired size and prove long-season layers of good-sized eggs—there is yet time to bring out ducklings of the laying-type, as these can be hatched and reared to advantage much later than chickens. Nevertheless, if only payable stock are to be raised there must be no delay in getting the full complement of young birds hatched out.

Where incubators are used duck-eggs require much the same treatment as hen-eggs, except in the case of applying moisture. After the fourteenth day the eggs should be well sprayed with water at a temperature of about 103° F. This may be applied with the mouth or a fine florist's spray. Do this after the eggs have been turned, and at once place the eggs back in the machine. They should not be cooled after the spraying. Spray in the morning and cool at night. This process should be repeated daily after the fourteenth day up to pipping-time. The ventilation-vents should be partly open, so that any excess of moisture not required by the eggs can get away. Never open the incubator and attempt to help the young birds out of the shell unless they have been given their full time to hatch. If the right degree of heat is maintained in the incubators—namely, 102° for the first week, and then 103° on to the pipping-time, and 104° when hatching—the ducklings will commence to pip on the twenty-sixth day and will hatch out about two days later. Therefore if the eggs "hang fire" after they have pipped, this need not necessarily cause anxiety regarding the result of the hatch. If any of the young birds fail to come out after the due hatching-time a good plan is to take a piece of thin flannel or blanket the size of the egg-tray, dipped in hot water and wrung lightly, and place this over the tray. This will have the effect of softening the membrane next to the shell and assisting the duckling to get out of its prison. If the flannel is sufficiently thin the ducklings will have no difficulty in hatching out under it.

For brooding ducklings both the heated and fireless brooder are suitable, providing of course they are of a desirable make. Whatever system is used care must be taken that an ample supply of fresh air is available to the young birds at all times. Fresh air is an important essential from the time when a duckling leaves the shell right through all stages of its development, and if there is neglect to provide this, trouble may surely be anticipated. On no account compel ducklings to sleep on damp or wet bedding, as this is a common cause of leg-weakness during the brooder stage. The drinking-vessels should be placed well away from the sleeping-compartment, as this will lessen the risk of the bedding-material becoming in a wet condition.

Ducklings require no food for at least thirty-six hours after they are hatched. During the first week the food may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, to which some fine grit should be added. Feed four times a day as much as the birds will pick up clean in a few minutes. After a week the grit need not be mixed with the food, but it should always be available to them in a receptacle, so that they can help themselves. After the first few days finely cut green stuff should be fed daily, and increased by degrees as the ducklings grow older. A little boiled mincemeat may be introduced to the ration by degrees as the young birds develop. From then on an ordinary mash made up of pollard, bran, gristed grains, &c., should be provided.

Never allow ducklings water to drink, after having had a long fast, until they have received a meal, or the mortality is apt to be great as a consequence. Water

should be given with the first meal, and from then onwards it should be left in reach of the birds both day and night. This is not to imply that the water-vessel should be left in the brooder-box (except perhaps for the first day), but rather that the ducklings should have access to the brooder-run at all times, where the water-vessel should be placed. It is not uncommon where ducklings have been confined in a brooder by night without water, and are given a drink before receiving their morning meal, for them to immediately fall over like ninepins.

Shade is another matter that must not be overlooked, for with ducklings hatched in hot summer weather sunstroke is a common source of loss. Ducklings should be well protected from their natural enemies, such as rats, stoats, weasels, &c., until they are about three-parts grown, otherwise they are apt to be killed by these pests.

OVARIAN TROUBLES.

This is the time of the year that ovarian troubles, such as protrusion of the oviduct, &c., are most common. This condition is usually due to overstimulation of the egg-forming organs by providing too much forcing-food, such as meat, milk, &c. These foods are specially demanded by the laying-bird during the winter months when called upon to produce her artificial product. In fact, at that time a good egg-yield cannot be obtained unless a fair amount of a forcing diet is included in the ration. In the spring and summer months, however, at what might be termed the natural laying season for bird-life, it is entirely different, for the good layer will give a heavy yield of eggs on a much plainer ration. It is therefore imperative that any forcing-material be provided with great caution at this particular period of the year. It is true that milk is a valuable drink for fowls, and a food as well, but there should be a limit to the quantity provided during hot weather, for not only is it apt to bring on ovarian trouble, but scouring and the production of double-yolked and shell-less eggs as well. The most common mistake made is to compel the laying-birds to drink a large quantity of milk merely for the purpose of quenching their thirst. Water in addition to the milk should always be available, so that the bird is not forced in order to secure a drink to take more of the latter than is good for it. Where milk is provided in large quantities for the birds to drink the risk of the troubles in question making their appearance will be considerably minimized if water is provided in a separate receptacle. Of course, there is nothing better than milk for growing stock, but with growing pullets, if given in too large a quantity, it is apt to promote egg-laying at too early an age. Where it is found that the birds are showing evidence of prematurity the milk should be sparingly used, or, better still, cut out of the ration.

FIGHTING VERMIN.

Now that the warmer weather is at hand vermin will commence to give trouble, and unless precautions are taken for cleanliness and keeping these parasites at bay the developing stock in particular will suffer as a consequence.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

QUEEN-REARING.

WHILE many honey-producers consider it more profitable to purchase all the queens they need from a reliable breeder, yet there are times and circumstances which make it advisable for all apiarists to be able to raise queens when needed. In the case of a beginner who wishes to learn all he can about bee-keeping it is advisable to purchase a good breeding-queen and try his hand at rearing queens.

The first essential, then, is to have a choice purebred queen from which to restock the apiary, and as it is generally conceded that the purebred Italians are the best race to rear it will be advisable to breed such. The characteristics desirable in a good queen are that she should be purely bred and mated, her stock good honey-gatherers and docile, and as far as possible non-swarmers. The only reliable method to ascertain if the queen is purely mated is to carefully observe the young bees that have recently been hatched, and if they show even marking throughout it may be considered the queen is purely mated.

The next essential in queen-rearing is to have a strong colony, with an abundance of young bees—a two-story hive for preference. A good system for the

beginner is what is called in New Zealand the Stewart method. The advantage claimed for this is that the queens are raised from natural cells. The method is as follows: During a good honey-flow find a strong two-story hive, hunt up the queen, and place her with two frames of brood in the top story over a queen-excluder; fill up with empty combs, when available, or full sheets of foundation. Three days later place a nice clean comb into the centre of the brood-nest of the breeder queen, so that she will commence to lay in it at once. Five days later this comb should be well filled with one-day-old larvæ. Then go to the prepared hive and remove the top box containing the queen, and place it on a new stand in another part of the apiary. Next carefully go through the bottom box and remove any queen-cells that may have been started. This is most important.

The prepared hive should now be hopelessly queenless, as any eggs laid by the queen prior to her being placed in the top box will have hatched and would be too old for the bees to raise a queen from. Now take away the frame of choice larvæ from the breeder queen and cut away the bottom of the comb saw-fashion, so as to leave ample room for the queen-cells—taking care that it is done in the warm part of the day, so that the young larvæ may not be chilled. Then place this frame in the centre of the brood-nest of the queenless colony. The bees will immediately commence raising cells on this prepared frame. Ten days afterwards it may be examined to ascertain how cells have been built. These should now be carefully cut out and one each placed in a nucleus hive. The latter should have been prepared a few hours previously by taking the frames of emerging bees, with adhering bees, and placing them in small nucleus hives. Or another good plan is to break up into nucleus colonies the hive that has raised the queen-cells, by putting two frames of bees and brood into nucleus hives and spreading them fan-shaped on the old situation, leaving all the entrances facing the same way as the parent hive. Then remove the now empty hive and give each small nucleus a queen-cell.

In cutting out the queen-cells care must be taken to cut well into the comb, so as not to disturb the base of the cell. These cells may be placed in cell-protectors and fastened to the centre of the centre comb. The cell-protector is not essential when utilizing the queen-rearing colony for nuclei, as the bees are used to the cells and will rarely tear them down, but if introducing the queen-cells to a queenless colony it is safer to use the protectors.

When the young queens are mated and laying—which should be in about ten days' time from hatching—they may be introduced to any colony desired, provided the queen of such colony is first removed and any queen-cells that have been started have been destroyed.

Another system of queen-rearing often adopted is the Doolittle method, which necessitates the removal of the young larvæ from the cells and grafting them carefully into prepared cups. This requires great care in handling, but large quantities of queens can be raised by this method. The latter is fully described in all text-books dealing with queen-rearing, but is not recommended for the beginner.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

TOMATOES: The first week in November is the best time to plant in nearly all places, the exceptions being extra warm localities where there is no frost. It is a great mistake to plant too early. The plants cannot make growth until the soil becomes warm and continues so. It is better to keep the plants in the boxes in a sheltered position until favourable conditions obtain than to plant when they can make no growth to speak of and are liable to severe checks from frost or cold snaps. While in the boxes the plants improve. They may make but little top growth, but the plants will be hardening and roots increasing, so that when they are planted out the plants are tough and hardy and well rooted. I am presuming that the plants have been raised at the proper time, not rushed along in a hurry; such plants are not worth having. There are a number of ways of training, and also a system where there is no training at all. Space will not allow details of the various plans, nor is it at present necessary. The actual planting and growing of the plants is the same in all cases. The main thing to aim at is a hardy and

strong plant to begin with, and then to continue in a direction that will maintain it in the same state. In some places highly favourable to tomato-culture there is always danger from late frosts, these not uncommonly occurring well into November. To my personal knowledge many extensive plantings have been lost in this way, and the losses could have been avoided. The plants were too soft when put out. That these losses were avoidable was proved by the fact that other large plantings subject to the same frost and the same exposure escaped uninjured. At some future time it may be well to explain this matter more fully; at present it must suffice to say that the plants should be of the description previously mentioned, and that they must not be watered when set out—any one with a superficial knowledge of plant physiology will know why. Apart from that, the plants establish themselves in a shorter time if not watered. When planting brush aside the dry surface-crumbs of soil, make a hole with a trowel deep enough to let the plant down to the first pair of rough leaves, return the soil, and press it firmly around the ball of roots. Evaporation from the leaves will cause the plants to droop under hot sunshine for three or four days. They will pick up each night, and after that will droop no more, but start at once into free growth. Before being planted out the plants should be sprayed with 4-4-40 bordeaux mixture. Washing-soda may be used in place of lime: in which case use rather more than 1¼ lb. of soda in place of 1 lb. of lime.

Broccoli: A start with sowing should have been made before now; at the present time all varieties may be sown; it is possible to get small heads by sowing much later. Experience shows that an early start is best, as in dry summers the diamond-back moth is so serious a pest as to make it impossible in many cases to save the plants unless they are well grown before it appears.

Carrots and Parsnips: The main crops should be sown during the first week of the month. Good free-working soil is necessary, but not of an overrich character. No fresh animal manure should be applied. Superphosphate may be used if necessary; about 2 oz. per square yard should be sufficient. Land that was well manured for another crop the previous season will require no addition. During the early part of the season when rain is frequent it is best to sow rather thickly, because a number of young plants succeed in breaking the beaten surface when a small number might fail to do so. Now, however, that germination is more rapid and there is little likelihood of there being too much rain, the seed should be distributed as thinly as possible, saving a great deal of labour in thinning.

Onions: Pickling-onions are obtained by sowing the Silver-skin variety on very poor soil, which must be of a good working description, towards the end of November. Make the surface firm by treading or rolling. Sow in broad drills about 1 ft. apart, rather thinly, and do no thinning. If weeds are not likely to be troublesome the seed may be broadcasted.

Other Sowings: Red beet of a long variety should be sown for winter use. Silver beet may be sown at almost any time of the year; possibly about now is the best time. The plants should be thinned to 12 in. apart. Sow a small breadth of turnips as required. Distribute the seeds rather thinly, and very little thinning will be required, this being done by pulling the roots as they become large enough for use. Cabbage and savoy should be sown about the 25th of November to provide the winter crop for the North Island. It is better to sow several weeks earlier in the South Island. Make successional sowing of peas, French and butter beans, lettuce, and radish. Pumpkins, marrows, pie-melons, water-melons, rock-melons, and hardy cucumbers should be sown in the open ground early in the month.

Asparagus: Cease cutting when peas come in. The heavier the crop that matures and dies down the better the prospect for the following season.

Celery: Early plants should be ready for planting out. Really good heads can be obtained only by the old trench method. There are many adaptations of this method, the principal difference being the width of the trenches and number of rows in a trench, the number sometimes extending to a dozen rows. The latest method is to use no trench at all, this being the plan at present most common in market gardens. A self-blanching variety—usually Henderson's White Plume—is grown. The plants are set out in beds 6 ft. to 8 ft. wide, with the plants about 10 in. apart. Close growing assists in the blanching. The resulting heads are small and not of great merit—quite satisfactory, however, for cooking purposes. The heads find ready sale, and though the price they bring is not great they cost little to produce and must be a very much more profitable crop than by the trench system. This plan is commended to those who are too busy to make trenches.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT FOR COW-POX.

O. W. G., Appleby :—

I have a cow which some three months ago suffered from an affection of the teats. It first appeared in the form of red pimples, which after a day or two turned into small sores; these in turn lasted about a week or ten days and then dried up. The cow has just come in afresh, and I find that the complaint has returned. Please advise.

The Live-stock Division :—

From the description we judge that your cow is suffering from cow-pox. Apparently the teats only are affected in this case; usually some lesions are found on the udder itself. Except from the initial feverish stage, and the pain brought about by the handling of the teats, the cow suffers very little, and the disease has no detrimental effect on the general health. Treatment should be directed to the healing of the sores. The milking should be done in as gentle a manner as possible. Where the teats are very sore a milking-tube might be used, care being taken, however, to keep the tube thoroughly clean. Boiling for five minutes before use is recommended. The teats should be bathed twice daily with a hot weak solution of washing-soda, carefully dried, and a little of the following ointment applied: Oxide of zinc 2 drams, carbolic acid ½ dram, oil of eucalyptus ½ dram, lard to 2 oz. As the trouble is contagious the cow should be handled last, or one person only allowed to attend to her.

TREATING BLOOD FOR FERTILIZER.

J. C., Taumarunui :—

I have an opportunity of obtaining a quantity of blood from the local slaughterhouse. What would be the best mode of treating it to make it applicable as a manure?

The Fields Instruction Branch :—

For small lots there are two methods that may be used: (1.) Put the blood into a jacketed metal container with an open top, and dry it either by steam or boiling water in contact with the outside of the vessel containing the blood. An ordinary large copper partly filled with water will serve the purpose very well, and into this you may put the vessel containing the blood. It is better to heat slowly, and stirring is an advantage also. Keep up the amount of water in the outside vessel, to make up for the evaporation of steam. The fresher the blood the less offensive will be the process. To the blood should be added ferric-sulphate solution equal to about 1 part of dry sulphate to 100 parts of blood. This will prevent frothing when the blood is heated up. After the blood is coagulated and most of the moisture is driven off it can be allowed to drain (say, on galvanized iron) and dried under cover. Do not allow it to get wet. (2.) A simpler method would be to mix 1 to 3 parts of quicklime to 100 parts of blood, which converts the blood into a solid cake that can be dried in the air without any putrefaction. As a result you will have a mixture that breaks down into a powder, without any offensive smell. No special plant is required, and the final mixture has a greater fertilizing value on account of the added lime. Moreover, when this product is added to the soil it decomposes more readily, and becomes available to plants more quickly than the blood that has been treated with ferric sulphate.

IMMUNITY FROM WOOLLY APHIS.

R. BROWN, Waiau :—

Can you inform me if any research has been made in connection with the reasons why of two apple-trees of different varieties growing side by side one is immune from damage by woolly aphis while the other is badly infested ?

The Horticulture Division :—

It is well known that certain varieties of apples are immune from attack by the woolly aphis. The reason for this immunity is a disputed point. The most generally accepted theory is that the bark of immune varieties is too hard to be pierced by the proboscis of the insects. The insects certainly will attack the immune varieties through large abrasions of the bark, which seems to support this theory. It is recorded that the wood of the Winter Majetin, a quite immune variety, has been analysed, and that it contains more lime than varieties that are affected by aphis. The additional lime might reasonably be expected to harden the wood. It is a fact that the wood of varieties that are most affected by the aphis is very soft in comparison with that of immune varieties.

CONTROL OF GORSE.

"GORSE," Whareama :—

On my property there is a considerable quantity of gorse growing on the river-bank, the soil being a soft silty formation. In some places it has been fired and allowed to come away green again, while in other places it has never been burned. Our County Council has now declared gorse a noxious weed, and I would ask your advice as to the best means of coping with the trouble.

The Live-stock Division (Noxious-weeds Inspection) :—

On river-bed land composed of sandy silt the most satisfactory and lasting method is to grub the gorse and put the land into cultivation for a few years, if it is possible to do so. The grubbing destroys the original plants, and the subsequent cultivation destroys all young seedlings which show up during the first year or two after grubbing. The land should then be sown down with a heavy seeding of strong holding grasses.

CLEARING LAWN-GROUND OF GRASS-GRUB.

"SUBSCRIBER," Oamaru :—

I wish to clear a small piece of lawn ground of grass-grub before resowing, and am anxious to know the mode of applying carbon bisulphide for soil-fumigation. I should also like to be advised if, in trying lime-water, a saturated solution should be used.

The Biologist :—

Really the best method of re-establishing an infested lawn is to keep the ground thoroughly cultivated during the months of October and November, and perhaps December, and then sow the grass-seed, provided water is available for watering the young grass. If no water is available, then the sowing should be delayed until the autumn. If this method is adopted no egg-laying will occur on the soft cultivated ground, and in consequence the grass will get a full year's start before any infestation can take place. Dealing with the grubs in the ground with carbon bisulphide is fairly satisfactory, but will not prevent egg-laying on the young grass if sown about October or November. Lime-water (saturated solution) will bring a good many grubs to the surface, but cannot be at all relied on as a method of control.

DIET, AND PROTRUDING RECTUM IN PIGS.

J. H. A., Manaia :—

I have some small store pigs some of which have the rectum protruding. They have been living on whey and turnips, and I have decided to change their food, thinking that this may be the cause of the complaint. I should be obliged for any information.

The Live-stock Division :—

A pig's diet should contain substances to assist in bone-making, and contain also a reasonable amount of protein. Neither of the feeding-stuffs given by you contains either of these in sufficient quantity to be useful. You should replace the whey with skim-milk in the meanwhile, and supplement it with pollard and a proportion of grain and linseed. While not condemning turnips, they should only be given sparingly. The feeding-troughs should be kept thoroughly sweet, and the pigs in a dry, airy sty free from draughts. The protrusion of the rectum should cease when you change the feed.

MOSS-INFESTED PASTURES.

Hill Bros., Piopio :—

We would like some information regarding moss-infested pastures. Our pastures were originally sown on bush clearings after firing, and have been grazed by sheep for the past dozen years. The land is hilly, and the climate very wet, with about 120 in. of rain per annum. We have ploughed a few acres and put down in grass after taking off turnips or oats, but this land is still infested with moss of two or three varieties. We have tried top-dressing with raw ground carbonate of lime, up to 1 ton per acre, and obtained no results.

The Fields Instruction Branch :—

Where pastures are infested with moss in a damp climate we would suggest that if possible the land be tine-harrowed and top-dressed with from 10 cwt. to 12 cwt. of burned or roche lime to the acre during the autumn, following with 3 cwt. of superphosphate to the acre during the following September. If quicklime is not available two or three times the quantity of carbonate of lime might be used instead. Should the matter be urgent tine-harrow before and after broadcasting 3 cwt. of basic superphosphate to the acre. This should be done as early as possible, in order to get the benefit of the spring growth.

STORING EGGS FOR INCUBATION.

"Subscriber," Mangere :—

What is the best method of storing eggs for the incubator? Do you approve of the method of storing in bran, on the large end, to avoid turning daily? Does blasting or thunder affect eggs that are being stored for setting? The blasting in this case is taking place about half a mile away.

The Chief Poultry Instructor :—

One cannot do better than store such eggs in bran, but I prefer to have the small end down. There is no need to turn the eggs daily. Of course, if they are being kept for, say, a fortnight the position of the eggs should be changed at least twice during this time. It is often said that thunder spoils the hatching-qualities of eggs, but my experience does not bear this out. The blasting you mention is taking place too far off to injure the eggs in any way.

STOMACH TROUBLE IN CALF.

R. B. S., Pukehuia :—

I shall be glad to know what treatment, if any, could be given to a calf with the following symptoms: It was feeding quietly in the paddock, but suddenly started to run around, always to the right, until it fell down. On placing it on the left side it immediately struggled until getting on its right side again. There was a certain amount of froth at the mouth, nostrils distended, and eyes dilated. It seemed to be in agony for just on an hour, when I killed it.

The Live-stock Division :—

The complaint described in your letter is frequently seen in young calves. It is due to acidity of the fourth stomach, causing coagulation of the milk in that organ, and giving rise to the symptoms described. Treatment is of very little use in this complaint, as usually the animal dies before it can be applied. As a preventive, however, a tablespoonful of lime-water can be given in the milk every time the animal is fed, with beneficial results.

GETTING RID OF WOODLICE.

C. F. L., Henderson :—

Would you kindly inform me of the best method of getting rid of woodlice on passion-fruit vines, orange-trees, and in a bed for raising tomato-plants ? Observation by lantern-light at night reveals hundreds of these insects on the passion-fruit vines, which have been completely ring-barked at intervals on the whole length of the vine. Young orange-trees are also being attacked in the same manner, while in the tomato-bed the woodlice are destroying the plants as fast as they show up.

The Horticulture Division :—

Woodlice will eat almost anything. Being night feeders they are rarely seen by day unless disturbed. During the day they shelter in any dry place, under and among dry rubbish of any kind, including dry manure or hay. Box edgings often shelter them, and a favourite place is between or behind boards, especially those of a frame or greenhouse. Lacking a better place they will hide in cracks in the soil. Boiling water poured into crevices during daytime will destroy large numbers. Burn all loose rubbish, or, if of a kind that will decay, turn it over and pour water on it. Cultivate well and keep the place clean. Woodlice soon desert a place that is frequently disturbed. If it is convenient to give poultry the run of the place they will soon clear them out. Young chicks are greedily fond of them, and they are useful in a greenhouse ; so also are the native frogs. Woodlice (*Oniscus ascellus*) are not insects, but crustaceans belonging to the same order as crabs, lobsters, and crayfish.

THE CURRANT-BORER.

W. F. Pannett, Scargill :—

Will you kindly inform me as to the best method of destroying the grub which eats into the pith of the branches of currant-bushes ? While liable to affection currants are scarcely worth growing.

The Horticulture Division :—

No effectual means have been found for preventing attacks of the currant-stem borer. Spraying with lime-sulphur is no doubt effective while it retains its strength, but it is more than doubtful whether a sufficiently strong solution could be applied while the bushes are in growth, and for a period no spraying is possible. The fact remains that many growers are very successful with currants. It is the black variety that is most attacked by borers and also that is most grown. The black currant will not succeed except on good land. It requires good cultivation, keeping the soil free from weeds and frequently stirred, also liberal manuring, to cause good growth. The stooling form of bush is adopted because by this means new growths are thrown up from below the surface of the soil. This makes it possible to frequently renew the bushes by cutting out wormy branches, which should always be burned to destroy the grubs.

TOP-DRESSING PASTURE.

W. H. E., Waihou :—

Will you kindly advise me as to the best time of the year to top-dress grass-land with basic slag ? Which top-dressing manure do you consider gives the quickest results in the spring ?

The Fields Instruction Branch :—

The best time to top-dress pasture with a high-grade basic slag would be during the month of May ; it will be found that considerable benefit is derived by the extra growth in the winter months. A top-dressing which gives the quickest return in the spring is superphosphate, applied at the rate of from 2 cwt. to 3 cwt. to the acre.

CLEARING GARDEN-LAND OF TWITCH.

"TWITCH," Westport :—

I have been trying to reclaim an old garden which had become infested with twitch, but find it almost impossible to break up. Could you advise as to its treatment ?

The Horticulture Division :—

There are two ways of clearing the ground of twitch. One is to break the land up and pick the roots out. If it is convenient to use a plough this would be the cheapest method. In such case the ground should be ploughed, then harrowed, and grubbed several times with a tooth cultivator. Most of the roots could be got out during one summer, and after that all stray roots should be taken out. If spade work is resorted to it would be best to trench the soil to a depth of about 30 in., placing the top spit with twitch-roots in the bottom trench. Very little would again come to the surface, and clean cultivation would prevent further trouble.

CORRESPONDENCE.

ERADICATING WILD OATS ON WHEAT LAND.

A CANTERBURY correspondent writes :—

"In the last July number of the *Journal* there is given among the 'Answers to Inquiries' a method of getting rid of wild oats. Knowing how widely these notes are read, may I be allowed to suggest an alternative method, which I think has the advantage of keeping the land under crop during the whole of the process of eradicating the wild oats. It is as follows :—

"In the autumn, after the affected crop is removed, grow a crop of Cape barley or Algerian oats for winter feed, either by ploughing and working the land and drilling the crop, or by broadcasting the seed on the stubble and ploughing very lightly (I use a disk plough) and then rolling. This germinates and finishes one lot of wild oats. Plough deeper in spring and drill rape, which will be fed off in December onwards—next lot of wild oats gone. In autumn plough and cultivate for oats and tares (a bushel of each), sown in, say, March, which will give a most lucrative crop of hay if cut in December just as the earliest oats have headed—third lot of wild oats gone. Plough shallow, roll, and leave for a few weeks till moisture comes ; then plough deep and sow in autumn with grass—fourth and fifth lots of wild oats gone. Leave in grass for a few years, when a few of the remaining oats may die, and then break up again and put in rape ; this should germinate any seeds that are left, so that the land will be ready for wheat once more.

"It will be seen that the crux of the method lies in the crop of oats and tares which occupies the land for the time of a cereal crop, but does not allow the wild oats to ripen. This crop is giving most satisfactory results with those farmers that have adopted it, as it can first be fed off in autumn and then produce an exceedingly heavy crop of hay in summer. It has further an excellent effect in smothering twitch that has been weakened by previous cultivation.

"My plan certainly does involve a temptation to let at least one crop (the oats and tares) go for so long as to let the wild oats ripen and shed their seed, and this would be fatal to the whole process. The plan given in the 'Answers,' however, to my mind, errs in the direction of being a counsel of perfection. It is the safest and surest and quickest plan, but it is so expensive that it is not likely to be often undertaken. My plan, on the contrary, works in perfectly simply with the ordinary operations of the farm : the oats are killed while profitable crops are being grown, and so it is much more likely to be adopted. In the case of twitch I have found farmers much more eager to modify their ordinary farming procedure so as to control the twitch than to adopt those heroic measures which alone can kill it directly, and I think that the same will apply relatively with wild oats. Of course, my plan demands an intelligent appreciation of the procedure recommended and an earnest endeavour to co-operate with nature's working."

THE BEET-SUGAR INDUSTRY.*

VICTORIAN EXPERIENCE AT MAFFRA.

(Concluded from September issue.)

Irrigation.

ALTHOUGH the beet crop holds remarkably well through dry periods because of its deep-rooting propensities, irrigation is undoubtedly very desirable in the Maffra district. It is a summer crop that absorbs a large quantity of moisture, and if by irrigation an abundance of this can be supplied during the youth of the plants to keep them growing freely without any check much better quality beets will be secured than if the plants are severely checked by lack of moisture in the summer and subsequently develop an abnormal growth in the autumn. High-quality beets need an abundance of moisture during the spring and early summer, and comparatively dry conditions towards autumn, in order that high sugar-content and purity may be encouraged to the utmost. This can best be regulated by irrigation. Any system of irrigation may show good results, but undoubtedly the furrow system is the best. Every second row should be furrowed out with irrigation-shovels placed on the cultivator. These furrows should be connected with the service channel or pipe, and water admitted in sections, as many rows as the water will supply being irrigated at the one time. In this way the water may be well controlled, and through the loose furrows it soaks well down to the subsoil without smothering the leaves, and very soon after the furrows may be cultivated to conserve the moisture. In this district irrigation is generally of most value in December and January, and sundry crops irrigated from time to time have responded most profitably.

Harvesting.

The term of beet-harvesting usually extends over the period March to June. A special two-point beet-lifter is used to lift the beets, or a single-furrow plough stripped of its mouldboard. The topping is done by contract at a price per ton, depending on the yield, and occupies a number of men. The beet-toppers pull and shake the loosened beets, and throw them into rows; then, with large beet-knives, they slice off the crown and tops, throwing the roots into heaps clear of weeds, &c. The carters fork the beets into drays, haul them to the factory or railway-siding, have them weighed and tared for dirt and faulty topping, and tipped from high beet-loading platforms into trucks, or dumped direct into the beet-bins ready for manufacture.

Excepting the crowns and tops, which remain with the grower as valuable stock-feed, the whole bulk of the crop has to be carted, and it would generally be considered unprofitable to cart beets more than five miles by road. The limits by rail depend on freight and loading conveniences. A good average yield of clean beets is 12 tons per acre, but a diligent grower should expect to do better than this.

Beet Pests.

The only serious trouble so far in this district has been occasional damage to the young beets by cutworms and tomato-weevils, but if taken in time these can be checked by the use of paris green or arsenate of lead. Nematodes, beet-blight, rust, root-rot, &c., have not yet occasioned any difficulty, and by rotation and careful cultivation growers should endeavour to avoid such troubles. Rabbits are partial to young beets.

General.

Good cultivation is essential to beet-growing, and this is the main reason why beet-growing improves the soil for other crops. Fertilization is very

*Bulletin No. 40, Dept. of Agriculture, Victoria, by W. L. Williams, February, 1920.

desirable, and growers in the Maffra district have now come to realize this, and seldom plant without fertilizers. The application of lime is good policy, but not yet practised to any extent here. Irrigation is the best assurance for consistent and profitable yields, and with a large irrigation system in course of construction for this district it should benefit beet-growers.

Systematic rotation of crops is very important, but rarely practised here; partly because farmers have been fortunate enough to get along all right without it. But as reducing areas, higher values, and increasing costs come into conflict with decreasing fertility, rotation will find its proper place in the maintenance and improvement of the productivity of the soil. Mainly have beet-growers neglected rotation, because they have to lease land at high rentals for short terms, and are compelled to grow beets on the same land from year to year. Although continuous beet-cropping is bad practice and not approved, it is interesting to note that, in spite of those who contend that beet-growing injures the soil, sugar-beets have now been grown on some portions of the Swan Estate, Stratford, for six consecutive years, and produced good crops every year. Regarding the influence of beet-growing on other crops, many favourable results have been observed. Four years ago Carr's Estate, Stratford, showed evident signs of being crop-sick. It was leased and put under beet for two seasons and yielded well. Immediately after the beet was lifted, in July, 1918, it was hurriedly planted to barley and oats, and yielded heavy crops of barley and 3 tons to the acre of oaten hay, quite superior to any adjacent crops. This area has again been cropped with barley and oats, and is yielding splendidly, and the oaten hay will again go 3 tons to the acre.

A farmer who follows diversified farming and rotation is well advised to give his best attention to 5 or 10 acres of beet rather than indifferently care for larger areas. A grower who is experienced and devotes himself almost wholly to beet-growing need have no anxiety about handling 100 acres of beet.

Beet-thinning is the main cash item of expense in the early stages, and the factories generally advance on any well-cared-for crop sufficient to meet this expense. As soon as deliveries commence growers secure progress-payments to meet the cost of harvesting. Labour is not difficult to secure if a good run and reasonable accommodation can be offered.

In America there are now being fully tested two beet-harvesting machines designed to mechanically lift the beets, top and place them ready for carting. These show great promise of success, and, if so, they will be a great economy, convenience, and encouragement to beet-growers.

General Beet-growing Methods and Approximate Costs.

The following is a very general estimate of beet-growing costs, which vary considerably according to the man and his methods, the farm, and the season :—

Dr.	Particulars.	Cost per Acre. £	s.	d.
1.	Select the best land unless a strict rotation can be followed. Rent	1	10	0
2.	Plough or cultivate deep in autumn, about 10 in. or 12 in.	0	15	0
3.	Cultivate	0	2	6
4.	Plough or cultivate just medium depth in early spring	0	10	0
5.	Cultivate to good tilth, and fine clean seed-bed	0	6	0
6.	Seed about September, 18 in. or 20 in. rows, ¾ in. deep, 10 lb to 12 lb. seed per acre, and fertilize	1	2	6
7.	Cultivate with special four-row cultivator immediately rows can be traced	0	2	6
8.	Thin when beets are very young to single beets at 10 in. to 12 in. spaces by contact	1	10	0
9.	Side-hoe beets	0	10	0
10.	Cultivate with special cultivator as required	0	7	6
11.	Irrigate and cultivate in December if required			
12.	Lift beets, special lifter, March to June	0	10	0
13.	Top beets by contract, 15-ton crop	2	5	0
14.	Deliver beets to factory, approximate	2	9	0
	Total costs	£12	0	0

Where a grower owns his own land and fully works his own teams he may pocket of these costs about half. If rightly irrigated the additional expense incurred should be handsomely repaid.

Cr.	Particulars.	Receipts per Acre. £ s. d.
1.	Clean beets, 15 tons, at 27s. 6d.	20 12 6
2.	Beet-tops, for fattening or dairying	1 0 0
	Total receipts	21 12 6
	Costs	12 0 0
	Net direct profit	£9 12 6

A good farmer under normal conditions should secure this return, but an indifferent farmer or adverse conditions may considerably lower the result. A good farmer under fortunate conditions may increase the advantage. The above costs at the moment are inclined to rise, but against this the local price for beets has been increased to 30s. per ton.

BEET-SEED.

Supplies of high-grade beet-seed have always been procured from Europe, but during the war seed was most difficult to secure, prices advanced fourfold, and the pre-war standard of quality was not retained. Quality is all-important to the factory, but the Maffra growers are not yet directly interested, because they are paid a flat rate for their beets regardless of quality. When the industry is more fully established there is little doubt beets will be purchased on a basis of sugar-content.

Beet-seed may be satisfactorily grown here, but the maintenance and improvement of its sugar-producing propensities is a most elaborate business, demanding exceptional care and heavy outlay that may only become justified as the beet-sugar industry develops and creates a reasonable local demand for beet-seed.

Science has perhaps affected the characteristics of the sugar-beet more than those of any other known plant. Originally an annual, it has been influenced to develop sugar the first season and defer seeding until the second, thereby improving its opportunities for the development of sugar and lengthening the term for its extraction. Little over a century ago the plant yielded about 5 tons per acre of beets containing 5 per cent. of sugar. By most rigid selection and careful breeding the sugar-beet now yields from 10 to 20 tons per acre, and the beets test normally 15 per cent. to 16 per cent. of sugar, and sometimes reach as high as 25 per cent. of sugar. Such beets would naturally revert to a much lower standard very rapidly if not persistently and scientifically cared for.

Without entering into the elaborate details of high-grade beet-seed production, the following will be sufficient to indicate that beet-seed-growing is an important industry which cannot safely be trifled with.

(1.) Specially selected super-elite pedigreed seed is planted towards summer. In the autumn every beet therefrom is carefully tested physically and chemically, and those few passing the rigid tests are siloed or stored.

(2.) In spring of the second season the stored mother beets are again submitted to physical and chemical tests, and planted to produce in the autumn a crop of super-elite and elite beet-seed.

(3.) In spring of the third season the elite seed is planted, and but lightly thinned to secure long, small mother beets called "stecklings," which are lifted in autumn and siloed.

(4.) In spring of the fourth season the "stecklings" are planted, and produce a crop of commercial seed in the autumn.

(5.) In spring of the fifth season this commercial seed is planted, and produces beets in autumn for the manufacture of sugar.

Every year the super-elite seed must be carefully selected for the foundation of a new series. Germany and France in particular have specialized in the production of high-grade beet-seed, and owing to the difficulties occasioned by the war America has gone rapidly, largely, and no doubt successfully into the business.

In this district the factory has had to content itself with catch-crops of beet-seed. A reasonably high-testing plot of beets is reserved through the

winter, and the roots are replanted the following spring as mother beets, yielding a crop of seed which is used commercially. This seed-production has been very successful, the cleaning of the seed rather difficult, but the method, of course, is not safe. It has served a useful purpose while European seed has been so hard to secure, and the seed is probably more virile than the imported, but to continue on these lines would adversely influence the sugar-content. If elite seed were procurable from year to year the factory could produce its supply of commercial seed, which would have the advantage of being acclimatized, but it is unlikely that any reliable firm could be induced to part with its elite seed.

While the quality of the seed is so supremely important to success that no factory should even think of purchasing any but the very best, it is remarkable how climatic conditions may influence the sugar-content of beets and sometimes bring unjust criticism on the quality of the seed used. As an example, a set of results is submitted for comparison of Maffra results against Western District. The seed used in both districts was home-grown, and produced at the Maffra factory from a French strain of seed. The season 1918–19 at Maffra was exceptionally dry right throughout the growing-period, and the beets were stunted. At the usual time of maturity heavy autumn rains set in, and the stunted beets took on a second growth with a lowering of sugar-content and purity to such an extent that the average sugar-content for the whole of the season's beets at Maffra was only 13·49 per cent. The Western District beets evidently enjoyed a fairly normal steady growth throughout the summer, being favoured with the usual coastal showers. The beets consequently received no serious set-back, and came steadily to maturity, resulting in a much higher sugar-content than the Maffra beets produced from exactly the same line of seed.

Maffra Home-grown Seed (French Strain).—Sugar-content influenced by Climatic Conditions.

Plot No.	Location.	Topped Beet.	Sugar.	Purity.*	Sugar-content per Acre.	Remarks.
	1918-19.	Tons per Acre.	Per Cent.	Per Cent.	Tons.	
1	Maffra ..	15	14.0	80·6	2·10	Abnormal climatic conditions; unsteady growth.
2	,, ..	15	14·4	81·1	2·16	
1	Port Fairy ..	20	18·0	90·6	3·60	Fairly normal climatic conditions; steady growth.
2	,, ..	18	18·4	86·6	3·31	
3	,, ..	19	17·2	91·4	3·27	
4	,, ..	11	17·2	91·0	1·89	
5	Warrnambool	17	19·0	88·6	3·23	
6	,,	24	20·4	89·8	4·89	
7	,,	23	18·4	88·1	4·23	
8	,,	18	19·0	86·5	3·42	
9	,,	13	20·0	89·1	2·60	

* High purity favours a high extraction.

The production of single-germ beet-seed is receiving a lot of attention in America, because such seeds would economize the cost of thinning considerably, and there seems every reason to believe that such a characteristic may be developed and fixed in course of time.

Imported sugar-beet seed a few years back could be distributed at 6d. per pound; recently it has cost in some cases as high as 2s. 6d. per pound, and is now being distributed to growers at 1s. 6d. per pound.

ESTABLISHMENT OF BEET-SUGAR FACTORIES.

The location and construction of a new beet-sugar mill calls for a lot of forethought and consideration, yet one is safe in saying that there is only one thing that need very seriously exercise the minds of those interested—"an assurance of a satisfactory supply of beets from year to year." This is most essential, and if assured an up-to-date efficient mill has no excuse for anything but success.

The supply of raw material is so important that no district should consider the beet-sugar industry without reasonable proof that the soil and growers are capable and willing to produce plenty of beets. When the farmers have promised suitable support in the way of raw material, which is more important than cash, then the promoters should secure independent rights over a few thousand acres of land to balance results against the natural inclination of many farmers to follow occasional high but varying priced crops. Frequently they follow such fancy crops one year too late. Furthermore, industrious beet labourers and new-comers sometimes desire to launch out as beet-growers, and the factory can then accommodate them with land at reasonable rates; whereas uninterested landowners are often disposed to force rents up unreasonably. The factory needs to regulate its supply, and to encourage growers to grow beets as profitably as possible, and a substantial area of land in the hands of the promoters to be subleased on easy conditions and cropped on a rotation basis is a great advantage and necessary to balance the production from year to year.

Capacity of Factory.

(Advisable for present Victorian conditions.)

A factory capable of treating 500 tons of beets per day is desirable. America tried European methods and small-capacity mills, and practically all of these failed financially because America had to face high costs for labour and material. Very much improved labour-saving and larger-capacity plants were then tried, and T. G. Palmer, a noted sugar authority, says, "To-day a 500-ton factory is regarded as the minimum-sized factory for profitable operation in America." These efficient plants have invariably made good wherever the supply of beets has been satisfactory. A majority of American mills treat 1,000 tons per day. At the same time it is not advisable to have the capacity of a mill ahead of the quantity of beets readily available within easy distance.

To satisfy a 500-ton mill 4,000 acres of beet is desirable, but the first season both growers and factory would be better served to start off with a smaller acreage well cared for, as it is a crop that demands good and very prompt attention at certain stages. Inexperienced growers and labourers would be more worried over half the area the first season than the full area after experience.

Cost and Factory Requirements.

Under present conditions it is impossible to make anything but a vague estimate of the cost of a 500-ton mill. Probably £150,000 plus working capital, plus sundry beet-loading and railway facilities, might be required, and undoubtedly a large part of the plant could be made in Australia to advantage. This would be a heavy outlay, due to the prevailing high costs, but running at capacity such a mill would directly employ six hundred men in field and factory, and be of interest to a very large number indirectly. Also at capacity it should annually produce sugar, &c., to a value approaching or exceeding the factory cost of £150,000.

	£
40,000 tons of beets would cost	60,000
Manufacturing costs, repairs, &c. (estimate) ..	45,000
Other costs, including management, interest and depreciation (estimate)	20,000
Operating-costs	125,000
Value of products, sugar, &c. (say)	145,000
Balance	£20,000

The running-costs and value of products are liable to much variation, and should only be taken as a very general indication of results. For safety the above valuation of products has been taken at a low figure.

A supply of 3,000,000 gallons per day of good water would be required during the operating-period. 5,000 to 6,000 tons of coal would be needed per annum, also 1,500 to 2,000 tons of high-grade lime rock. Large quantities of sugar-bags, cotton filtering-material, coke, manufacturing-supplies, and beet-seed would also be necessary.

A factory-site should be central to the beet areas, convenient to railway service, well drained, and such that surrounding areas could be irrigated with the waste waters if necessary.

The value of the industry to its district and the State is best measured by the amount of employment and the wealth it may produce and distribute per acre of land involved.

GENERAL INFORMATION.

America has nearly one hundred beet-sugar factories, producing about 800,000 tons of sugar, while cane interests represent about 250,000 tons; but America's home requirements are over 4,000,000, tons per annum, made good by large supplies from adjacent cane-sugar producers, mainly from Cuba. America is now learning to appreciate the many economic advantages of producing as much home-grown sugar as possible, and, realizing the improvement in agricultural methods due to sugar-beet-growing, the Government is doing its best to encourage expansion.

The demand in America, as in Australia and elsewhere, seems likely to keep well ahead of available supplies, and the *per capita* consumption is certain to increase with the improved living-conditions and the realization that sugar is one of the very cheapest forms of energy-producing food. The heat units of sugar amount to 1,814 per pound, which is very much ahead of most other foods, and distinguishes it as a particularly valuable energizing substance. At 3½d. per pound this "concentrated sunshine" is probably the cheapest and pleasantest means of developing and maintaining human energy.

The *per capita* consumption of sugar prior to the war in some of the principal countries was approximately as follows: United States, 89 lb.; England, 93 lb.; Germany, 45 lb.; Austria-Hungary, 29 lb.; France, 44 lb.; Russia, 25 lb.; Italy, 12 lb.; Australia (1918–19), 120 lb.

The world's production of sugar has shown a steady increase, but recently the demand has outstripped the supply, which has been steadied by the war. With a strong demand and many European beet-sugar factories destroyed, the production is not likely to fully satisfy the growing demand for some years to come.

World's Sugar-production.

Year.	Cane.	Beet.	Total.
	Tons.	Tons.	Tons.
1850	1,200,000	200,000	1,400,000
1860	1,341,000	450,000	1,791,000
1870	1,741,000	846,000	2,587,000
1880	2,027,000	1,820,000	3,847,000
1890	2,443,000	3,669,000	6,112,000
1900	5,959,000	5,944,000	11,903,000
1910	8,566,814	8,503,970	17,070,784
1914–15	10,165,700	8,216,800	18,382,500
1915–16	10,675,700	5,032,000	15,707,700
1916–17	11,383,800	5,673,200	17,057,000
1917–18	12,505,800	5,050,600	17,556,400

The world's requirements are now computed to be 21,000,000 tons plus a substantial annual increase for the future.

The production and consumption of sugar in Australia since 1911 has been approximately as follows:—

Australian Sugar-production.

Period.	Production.	Consumption.	Period.	Production.	Consumption.
	Tons.	Tons.		Tons.	Tons.
1911–12 ..	190,595	233,000	1916–17 ..	193,037	266,000
1912–13 ..	129,877	241,000	1917–18 ..	327,589	274,000
1913–14 ..	265,029	255,000	1918–19 (estimated)	199,000	279,000
1914–15 ..	245,876	264,000	1919–20 (estimated)	155,000	285,000
1915–16 ..	159,640	262,000			

With a growing population and demand there is scope for increased production. Apart from its direct worth in sugar the beet-sugar industry has been responsible for a notable and favourable influence on the agriculture of every country where it has been established. Both France and Germany largely put the beet crop in place of a bare fallow in their rotation system, and secured, in addition to the sugar, improvements up to 100 per cent. on the yield of grain crops so influenced. Australia's wealth and strength undoubtedly depend on the rapid and intense development of her rural interests, and the sugar industry, cane or beet, is capable of playing a most valuable part in such development, because it demands intense culture, and produces so much wealth per acre. Australia's sugar bill will soon largely exceed £10,000,000 per annum, an amount much better spent in Australia than abroad.

Some Difficulties.

Against the beet-sugar industry and many other industries the Australian frequently shows an inexcusable amount of prejudice and lack of patriotism, due

THE MAFFRA BEET-SUGAR FACTORY.

Beet-plot in foreground.

undoubtedly to a form of national modesty which causes him to denounce local products and praise imported. A little pride and confidence in our own products may be a wonderful stimulus to help increase production and improve the quality of our goods.

Constantly one finds people declaring that beet-sugar is useless for jams and preserves, and it is quite refreshing to read a recent report on "Why English confectioners prefer beet-sugar to cane for high-grade confectionery!" The reasons are substantial and interesting, but too lengthy to review here. In general, Europe has always held a splendid reputation for the quality of her confections, preserves, jams, and condensed milk manufactured almost entirely with beet-sugar. Chemically refined beet and cane sugar cannot be distinguished one from the other. They both adhere to the one chemical formula, $C_{12}H_{22}O_{11}$. It may be sometimes possible, but by no means certain, for manufacturers to distinguish by the grain. Housewives need have no anxiety in using beet-sugar. Europe has given it one hundred years' successful experience. America has made elaborate and definite tests with both sugars, and could find no difference in the results of the preserves and jams so tested. If the home-made jams and jellies fail it is

due either to faulty methods of manufacture, or more likely to the fruit. Wet-season fruits are far less favourable in quality than those matured under sunny conditions, and variations in quality can only be partially corrected by special care in boiling. If the fruit or boiling is faulty it does not seem right, though it may be convenient, to blame the sugar, which in itself is quite pure.

Even the landowner frequently takes a delight in declaring that sugar-beet-growing ruins the soil. With correct farming it can and does actually *improve* the soil. It certainly absorbs a lot of moisture, but that does not impoverish the soil, because it is constantly being replaced. From a sugar-production point of view the beet is simply a plant developed in the soil to manufacture sugar from constituents not of the soil. Sugar, or $C_{12}H_{22}O_{11}$, signifies a combination of water and carbon. The beet-leaves play a most important part in the production of sugar. They are studded with stomata, or breathing-pores, which breathe in carbon dioxide from the atmosphere, assimilate the carbon, and set free oxygen. Under the influence of the green colouring-matter of the leaves, or chlorophyl, and sunlight, the carbon dioxide combines with water in such a way as to form probably glucose first, then starch, gradually liberating the oxygen. Starch is insoluble, and is transformed into sucrose and glucose, and conveyed in solution to all parts of the beet-plant to aid its development, and towards maturity to store a liberal supply for the subsequent reproduction of the plant by developing seed. By harvesting the beets at maturity this seeding function is intercepted, and the stored sucrose is manufactured into commercial sugar for human consumption. Thus is energy actually won from the atmosphere and stored in the beet as sugar or "concentrated sunshine," becoming available under manufacture as a most valuable energy-producing food. From this it may be understood that the actual sugar in the beets does not in any way rob the soil of plant-food. The plant itself absorbs a quantity of plant-food, but with correct farming a great part of this may be restored to the soil in excellent form for subsequent crops. The tops and crowns which contain the bulk of the plant-food may be ploughed in or fed off and the manure ploughed in. The pulp containing the balance of the plant-food may also be fed to stock and returned in the form of manure. However, the great reasons for the improvement of the soil by beet-growing are—(1) The persistently intense deep culture demanded by the beet crop invariably improves the texture and productivity of the soil; (2) the deep-rooting disposition of the sugar-beet causes it to throw down a deep tap-root, under examination found to be massed with fibrous roots. These roots and countless rootlets reach to depths quite unusual with most crops, and greatly enrich the soil by bringing up fresh supplies of plant-food from the subsoil to the surface soil. At the same time they open up and aerate the subsoil, and add a mass of humus in the form of root-matter which gives life and vitality to the soil, and is so essential to fertility.

Both consumers and producers of beet-sugar might reflect on these matters, because practice as well as knowledge indicates that the industry is worth commendation rather than prejudice and denunciation.

CONCLUSION.

Regarding the Maffra beet-sugar industry it must be borne in mind that the mill was constructed over twenty years ago when manufacturing labour and materials were cheap. With this same plant, after lying idle for ten years and with no important improvements, the Department of Agriculture has made a clear demonstration that beet-growing and sugar-manufacturing may under Victorian conditions be quite congenial, profitable, and of great advantage to its district.

It has shown that a substantial rainfall or irrigation is necessary. It has also shown that with success comes the tendency for landowners to make it difficult for growers to secure sufficient land at reasonable rates. Although the factory's substantially capitalized plant, forced to operate on a small acreage with increasing costs of labour and material, has shown a degree of success and a satisfactory demonstration, it is not to be expected that the industry can expand and take its rightful place as a vigorous industrial proposition without sufficient land to produce a satisfactory supply of raw material. Granted such, the mill, in order to cope with the supply and contend with high costs, would, as a matter of course, be remodelled and brought up to efficiency on a 500-ton-per-day basis, to the advantage of producer, worker, and consumer.

As a business proposition the Maffra factory, or any other mill that may develop, needs control of a substantial acreage of good land, suitable climatic conditions, and an efficient plant.

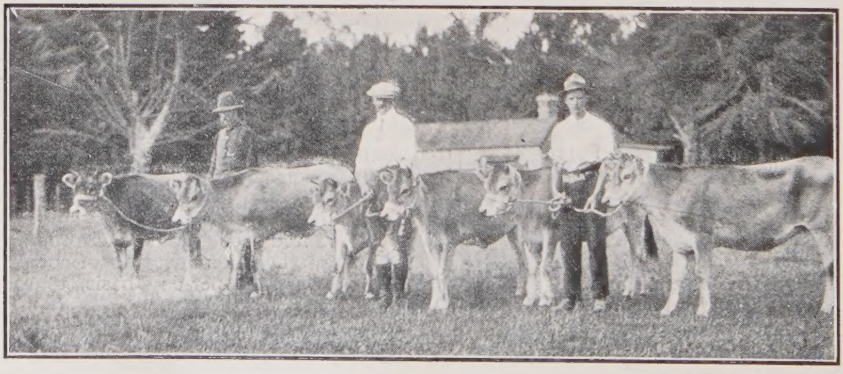
OFFENCES AGAINST THE FERTILIZERS ACT.

AT the Magistrate's Court, Wellington, on 17th September, the New Zealand Loan and Mercantile Agency Company (Limited) was prosecuted by the Department of Agriculture on charges (1) of having sold fertilizers the official analysis of which differed from the defendant's invoice certificate to the prejudice of the purchaser, and (2) of having omitted the unit values from the certificate. The fertilizers (turnip and grain manures) had been found to be deficient to the extent of over 6 per cent. in soluble phosphoric acid and in potash by 0·8 per cent., the value of the total deficiency being about £5 10s. per ton. The defendant company pleaded guilty, giving as an explanation of the first-mentioned offence that wrong invoice certificates had been supplied inadvertently. The defendant was convicted on both counts and fined £5 and costs, the Magistrate remarking to the effect that the explanation advanced did not help the farmer who bought the manure.

MOVEMENT OF BEES FROM THE AUCKLAND DISTRICT.

CLAUSE 4 of the regulations under the Orchard and Garden Diseases Act, for the better control of fire-blight (gazetted on 18th June last, and published in the *Journal* for July), unconditionally prohibiting the removal of bees from the Auckland District, has been revoked, and the following regulation substituted, coming into force on 23rd September, the date of gazetting: —

4. (1.) No bees shall be sent or brought from the prescribed area to any other portion of New Zealand unless such bees have been effectively quarantined for the six days immediately prior to their despatch from that area so as to prevent their having access to any flowers or other vegetation. (2.) The Director of the Horticulture Division of the Department of Agriculture shall appoint such places of quarantine, and shall prescribe such conditions for their use, as he deems necessary. (3.) Before sending or taking any bees out of the prescribed area the owner shall have them quarantined at one of the appointed places of quarantine. (4.) After completing the prescribed period of six days in quarantine the bees shall be forwarded direct from the quarantine place to their final destination, an official permit signed by an officer of the Department of Agriculture being attached by tag or label to each parcel of such bees. (5.) No bees shall be accepted for posting or for consignment by rail to an address outside the prescribed area without such official permit being attached to the parcel. (6.) All expenses of sending bees to a place of quarantine and of forwarding them on completion of their period of quarantine to their destination outside the prescribed area shall be borne by the original sender of such bees, and shall be payable on demand.



"GOLDEN SWAN" HEIFERS AT RUAKURA.

LAND FOR RETURNED SOLDIERS.

THE lands opened or to be opened during the current month comprise an area of 9,536 acres, subdivided into 120 holdings, mostly suitable for dairying. The principal settlements are Grange, Dromore, Broadfields, and Isleworth, comprising twenty-four holdings, all situated in Canterbury, and suitable for agriculture or dairying. Part of the sections in Isleworth Settlement have been sown in wheat and oats. The Waari Hamlet Settlement has been subdivided into twenty-seven holdings, in areas suitable for fruit and poultry farming. This settlement is close to Waikumete Railway-station, near Auckland, and is therefore adjacent to good markets. Other settlements to be opened in October are Paremata (in Hawke's Bay District), Tawhiwhi (in Taranaki), and also several areas of Crown lands scattered throughout the Dominion.

The lands at present notified as being open for selection during November are: Glangarry, near Dannevirke, of 1,950 acres, subdivided into twenty-three sections; Goat Hills Settlement, in Marlborough, of 5,046 acres, subdivided into four good grazing-areas; four pastoral runs, with areas of settlement land attached as homestead-sites, situated in Otago; and numerous areas of Crown land. The Morten Settlement, containing 68 acres, subdivided into thirteen sections, has been set apart for selection by tuberculous soldiers only. This settlement is situated near Mount Pleasant, Sumner, and should prove very beneficial to the health of the soldiers for whom it has been set aside.

AGRICULTURAL BURSARIES.

THE following is an extract from the annual report of the Minister of Education for 1919–20:—

A system has been in operation since 1917 under which agricultural bursaries may be granted by the Education Department to qualified candidates in order to enable them to obtain necessary practical training for positions as teachers, or agricultural instructors, or as farmers. After the completion of their training the bursars are under a legal obligation to serve for a term of three years in one or other of these capacities.

The qualification for a bursary is Matriculation or a higher or lower leaving-certificate, and candidates are preferred who have received agricultural instruction during their secondary-school course. In addition, ex-students of teachers training colleges who desire to specialize in the teaching of agriculture may obtain bursaries to enable them to receive the necessary training in agriculture. Agricultural bursaries are tenable at an experimental farm, an agricultural college, or other approved institution for two years, with a possible extension to a third year. Bursars receive an allowance of £20 per annum with free tuition, and if obliged to live away from home a lodging-allowance of £30 per annum.

During 1919 nine agricultural bursars were in attendance at Lincoln Agricultural College, and one at Auckland University College. Seven of the bursars at Lincoln were in their second year, and the bursar at Auckland was in his third year, having spent the two previous years at the Central Development Farm, Weraroa. In almost every case the reports of the work of the bursars were highly satisfactory. The expenditure by the Department on agricultural bursaries in 1919 was £608.

The regulations under the Education Act governing the award of bursaries for the purpose of promoting the study and practice of agricultural science (published in the *Journal* for February, 1917) were amended last month in several respects. The chief alterations in the conditions of tenure are: After completion of the original term of two years the bursary may be extended, in approved cases, for a further two years, instead of for only one year as formerly. The category of educational institutions at which the bursaries are tenable has been extended to include University colleges. The choice of occupations, in one of which each bursar must serve for a period of three years after completing his course of study, has been narrowed to that of teacher in a public, secondary, technical, or registered school, or in an agricultural college.

FORTHCOMING AGRICULTURAL SHOWS.

Marlborough A. and P. Association: Blenheim, 26th and 27th October.
Poverty Bay A. and P. Association: Gisborne, 26th and 27th October.
Wairarapa and East Coast A. and P. Society: Carterton, 27th and 28th October.
Manawatu and West Coast A. and P. Association: Palmerston North, 3rd, 4th, and 5th November.
Canterbury A. and P. Association: Christchurch, 11th and 12th November.
Wanganui Agricultural Association: Wanganui, 17th and 18th November.
Banks Peninsula A. and P. Association: Little River, 23rd November.
Thames Valley A., P., and H. Association: Te Aroha, 24th and 25th November.
Auckland A. and P. Association: Auckland, 3rd and 4th December.
Southland A. and P. Association: Invercargill, 14th and 15th December.
Tuapeka Agricultural Society: Lawrence, 27th December.
Woodville A. and P. Association: Woodville, 25th and 26th January.
Feilding I., A., and P. Association: Feilding, 1st and 2nd February.
Clevedon A. and P. Association: Clevedon, 5th February.
Otago A. and P. Society: Dunedin, 9th and 10th February.
Dannevirke A. and P. Association: Dannevirke, 9th and 10th February.
Masterton A. and P. Association: Solway, Masterton, 15th and 16th February.
Northern Wairoa A. and P. Association: Aratapu, 19th February.
Franklin A. and P. Society: Pukekohe, 25th and 26th February.
Egmont A. and P. Association: Hawera, 2nd and 3rd March.
Morrinsville A., P., and H. Society: Morrinsville, 9th March.
Matamata A. and P. Association: Matamata, 15th March.
Ashburton A. and P. Association: Ashburton, 17th March.
Methven A. and P. Association: Methven, 31st March.
Mayfield A. and P. Association: Mayfield, 31st March.
Oxford A. and P. Association: Oxford, 7th April.
Temuka and Geraldine A. and P. Association: Temuka, 7th April.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)